FULL LINE CATALOG





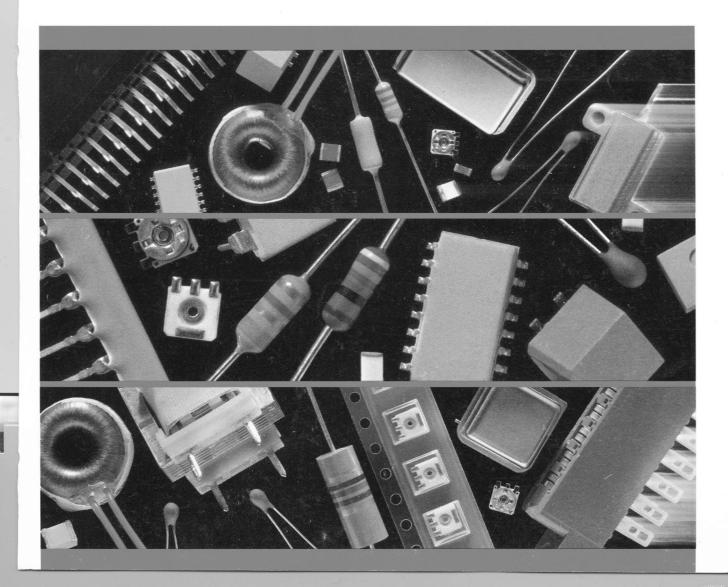
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COMMITMENT TO EXCELLENCE



Quality Policy

- Our commitment to quality starts with top management and extends throughout the entire work force.
 - Quality means conformance to all requirements.
 - Conformance is obtained by *prevention*, not detection or screening.
 - Conforming material and subassemblies are basic to quality and will be *required* from our suppliers.
 - Our people are dedicated to "Do it right the first time" and that is expected performance for each individual for each task.
 - Quality products and service to our customers is our *daily* task.

The Dale Management Team

General Index



General Index 1 Surface Mount Index 2 Alphabetical Index 3
Clock Oscillators Phone: (602) 967-7874
XOSM-52B, BE, surface mount, hybrid crystal 4 XO-43B, hybrid crystal
XO-54B, BD, BE, hybrid crystal8
Phone: (602) 967-7874, Dale
Phone: (818) 781-1642, Dale Techno Division
E08C, E10C, E15C, cermet trimmers, miniature
P11, PA11, modular, cermet potentiometers 10 P16, PA16, panel controls, "Pot in the Knob" 14
ST-22, -23, chip potentiometers, surface mount
ST53YJ, YL, cermet trimmers, surface mount . 18 ST63Y, Z, cermet trimmers, surface mount 20
T7YA, YB, cermet trimmers, miniature
TX, TXD, TY, cermet trimmers, miniature 24
T63, cermet trimmers, small size26
T93, cermet trimmers, small size
RJ24, cermet trimmers, MIL-R-22097, Type RJ32
RJR24, cermet trimmers, Established
Reliability, MIL-R-39035, Type RJR32
MIL-R-22097, Type RJ34
RJR26, cermet trimmers, Established Reliability, MIL-R-39035, Type RJR34
RT24, wirewound trimmers, MIL-R-27208, Type RT36
RTR24, wirewound trimmers, Established
Reliability, MIL-R-39015, Type RTR36 RT26, RT27, wirewound trimmers,
MIL-R-27208, Type RT38
Power Rheostats Phone: (301) 739-8722, Angstrohm
Phone: (402) 371-0080, Dale
Standard and Special Features40
MP06, 12.5 watt41
MP10, 25 watt
MP15, 50 watt
MP30, 150 watt
MP40, 300 watt46
Special Power Rheostats47
Wirewound Resistors Phone: (402) 563-6506
ESS, ESW, ESN, EGS, EGW, EGN, Established Reliability, MIL-R-39007,
Type RWR, R level48
ERH, ENH, Established Reliability, MIL-R-39009, Type RER, R level, housed 50
RH, NH, MIL-R-18546, Type RE, housed52
PH, precision, power, housed54
G, MIL-R-26, Type RW, precision, power 56
RS, MIL-R-26, Type RW, precision, power 58 RS, miniature, precision, power 60
WSC, surface mount, precision, power
LVR-1, -3, -5, MIL-R-49465, Type RLV
and commercial, precision, power62

LVR-10, MIL-R-49465, Type RLV32
and commercial, precision, power63
Ordering Specifications, HL resistors 64
HL, industrial power, tubular65
NHL, industrial power, tubular, non-inductive 65
HL, industrial power, flat
HLW, industrial power, tubular,
lug-attached leads
HLZ, industrial power, edgewound67
HLA, industrial power, adjustable68
HLT, industrial power, tapped68
Specifications, HL resistors69
CW, coated70
CW, miniature, commercial, coated
CA-1, -2, commercial, power
CPSM, surface mount, commercial, power 74
CP, axial leads, commercial, power
CDCI CDCC CDCD CDCE
vertical mount, commercial, power76
CPL, MIL-R-49465, Type RLV
and commercial, axial leads, power
and commercial, four leads, power78
CPR, radial terminals, commercial, power79
CPW, axial leads, commercial, power
CA-(X)F, fuse, axial leads, commercial power .81
CP-(X)F, fuse, axial leads, commercial, power 82
CPR-(X)F, fuse, radial terminals,
commercial, power83
RS-1F, fuse, molded, custom
Special Purpose Wirewound Resistors 85 CP-2M, surface mount, special purpose 86
SPR-2213, -2214, special purpose,
flameproof86
Special Purpose Wirewound, four terminal,
current sensing, heat sink styles, fuse clip 87
Special Purpose Wirewound, housed,
terminal variations
Special Purpose Wirewound, custom89
Film Resistors
Phone: (402) 371-0080, Dale Phone: (818) 781-1642, Dale Techno Division
Phone: (301) 739-8722, Angstrohm
Checklist for Ordering Film Resistors90
TNPWM, thin film chip, surface mount,
Established Reliability, MIL-R-55342/7,
Type RM, precision91
TNPW, thin film chip, surface mount,
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision 92 SMM0204, thin film cylindrical chip, surface mount, (MELF), industrial, precision 93 Thick Film Chip Resistor Design Kit 94 CRCW0603, thick film chip, surface mount, industrial 95 CRCW, thick film chip, surface mount, industrial 96 RC, RCWP, RCW, thick film chip, surface mount, industrial 96 RC, RCWP, RCW, thick film chip, surface mount, industrial 98 RCM, RCWPM, RCWM, thick film chip,
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision
TNPW, thin film chip, surface mount, industrial, precision

PTF, metal film, industrial, precision,
low T.C., tight tolerance
CMH-55-100, metal film, industrial,
high value109
CPF, metal film, industrial, power,
flameproof110
FP55E, 60E, 55C, 60C, 55D, metal film,
precision, flameproof
ERL, metal film, Established Reliability,
MIL-R-39017, Type RLR114
HN, metal film, Established Reliability,
MIL-R-39017, Type RLR, semi-precision 115
ERC, metal film, Established Reliability,
MIL-R-55182, Type RNC116 CJ, CH, metal film, Established Reliability,
MIL-R-55182, Type RNC and RNR118
HN, HS, HT, HY, metal film, Established
Reliability, MIL-R-55182, Type RNR
and RNN, hermetically sealed120
SMH, metal film, surface mount, (MELF),
hermetically sealed
CMF, metal film, MIL-R-10509, Type RN,
MIL-R-22684, Type RL122
NE, NC, CT, NA, metal film, MIL-R-10509,
Type RN, precision124
CT, C, FP, metal film, MIL-R-22684, Type RL,
semi-precision
withstanding protective128
CMF-55-39, CMF-60-64, metal film, special
purpose, fusible, flameproof130
R-1C-16A, metal film network, discrete, DIP . 13
R-4C, R-5C, metal film network, discrete, SIP 13
RNX, metal oxide, high voltage
FHV, metal oxide, high voltage
HVW, MVW, HVX, metal alloy, high voltage 138
SPW, carbon film, high frequency
load (tubes)
B, H, D, G, carbon film, high voltage140
HACW-2, HADW-2, M-51, oxide and carbon film, ultra high value14
carbon film, ultra high value
high value142
RDX, metal oxide, high voltage, ratio divider .142
TR, TD, thick film, resistors and dividers,
high voltage143
Thick Film Resistor Networks,
Resistor/Capacitor Networks,
Capacitor Networks, Ladder Networks
and Custom Networks
Phone: (402) 371-0080 Dale Phone: (818) 781-1642 Dale, Techno Division
SOGC , resistor networks, surface mount, small outline, molded, DIP, 16 or 20 pins 144
SOMC, resistor networks, surface mount,
small outline, molded, DIP, 14 or 16 pins 14
CSC, resistor networks, coated, SIP148
MSP, resistor networks, molded, SIP 152
MDP14, 16, 18, resistor networks,
molded, DIP
mDP16-45, -46, resistor networks, molded, DIP158
DFP14, DFP16, resistor networks,
flat pack

General Index/Surface Mount Index



Thick Film Resistor Networks, Resistor/Capacitor Networks, Capacitor Networks, Ladder Networks
and Custom Phone: (402) 371-0080 Dale
Phone: (818) 781-1642 Dale, Techno Division
M83401/04, 05, 06, 07, 08, 09, resistor networks, MIL-R-83401, SIP162 MSM, resistor networks, MIL-R-83401,
Type RZ, molded, SIP164 M8340101, M8340102, resistor hetworks
MIL-R-83401, DIP
MIL-R-83401, Type RZ, DIP170 DFM14, resistor networks, MIL-R-83401,
Type RZ, flat pack
TRC, resistor/capacitor networks, coated, SIP178
R/C Networks, surface mount, SIPS, DIPS 179 CSRC, resistor/capacitor networks, coated, SIP182
MDRC, resistor/capacitor networks,
molded, DIP
TxxS, R/2R ladder networks, coated, SIP 187 T14L10, R/2R ladder networks, DIP 188
T16L08, T16LR8, R/2R ladder networks, DIP 189
NTC Thermistors Phone: (818) 781-1642 Dale, Techno Division
7, 8, surface mount, hybrid chip190
1B , uncoated disc, material "B"
1J, uncoated disc, material "J"
high stability, Thermoceram
10, 20, 30, 40, 50, 60, coated
Phone: (915) 592-3253 Dale
W, surface mount chip
NTHS, surface mount chip
NTHD, uncoated disc, curve 1
NTHD, uncoated disc, curve 2
SSN, soft start, inrush current suppressing 212
X, M, C, F, T, B, coated214
NTC vs. Temperature Curves216 NTC Thermistors, curve tracking
and point matched
How to Select an NTC Thermistor
NTC Thermistor Conversion Tables 223
Ceramic Power Capacitors Phone: (207) 284-6093
Power Capacitors, water cooled, plate, feed-through, tubular rimmed, pot, barrell and high voltage
Inductors Phone: (605) 665-9301
IMC-1210, surface mount, molded
IMC-1812, surface mount, molded231
ISC-1812, surface mount, molded, shielded 232 IS, surface mount
IMS-5, MIL-C-15305, Type LT
and commercial, molded, shielded

IMS 2 MIL C 15305 Type I T and	
IMS-2, MIL-C-15305, Type LT and commercial, molded, shielded, miniature 23	
IM, MIL-C-15305, Type LT and	
commercial, molded23	
IR. coated	
IRF, coated	
IH, high current, filter inductors	
IHA, high current, filter inductors	
IHD, high current, filter inductors	
IHB, high current, filter inductors	
IHM-2, high current, filter inductors24	
IHV, high current, filter inductors24	
Custom Magnetic Components25	
Surface Mount Inductive Components 25	
TE, TD, filter inductors, toroids	52
Transformers ************************************	
Transformers Phone: (605) 665-9301	
TA, audio, telephone coupling25	56
PT, ISDN	
PT-10, -20, pulse, trigger type	
PT-50, power, trigger, SCR isolation	34
TC, converter	
PLS, PLD, power	35
PL-11, -12, -13, -14, -32, -33, -34, low power 26	00
PL-22, -23, -24, -42, -43, -44, low power 27	70
	10
Connectors William William W	
Phone: (605) 665-9301	
FR4 FR6 FR7 FR8 high temperature	
150°C and 200°C burn-in standard	
150°C and 200°C burn-in, standard and right angle27	72
FR4 edgeboard dual readout standard	
and right angle27	78
EB6, edgeboard, dual readout, standard	
and right angle28	21
EB7D, edgeboard, dual readout	2/
EB7S, edgeboard, single readout	
EB8, edgeboard, dual readout	
EBT156, edgeboard, single readout	
300, printed circuit board, dip solder	
DSEB, D-subminiature/edgeboard hybrid 29	
MM22, MM24, rack and panel,	90
MIL-C-28748/7,/8 and commercial,	
microminiature, rectangular	91
	20
rectangular	13
Special Application Connectors30)/
Plasma Panel Displays	
Phone: (402) 563-6506	
Plasma Flat Panel Displays30	18
Dot Matrix Plasma Display Modules31	10
DC Plasma Display Modules31	
APD-016M040, modules, 16 characters 31	
APD-064M033, modules, 64 characters 31	14
APD-080M025-1, modules, 80 characters 31	
APD-128G128, 128 x 128 graphics modules . 31	
APD-192G088, 192 x 88 graphics modules 32	00
APD-192G088-5, 192 x 88 graphics modules	-0
with infrared touch screen	22
APD-192G096 , 192 x 96 graphics modules 32 APD-222G007 , 222 x 7 graphics modules,	4
up to 27 characters in taxt mode.	00
up to 37 characters in text mode	02
APD-240G120, 240 x 120 graphics modules . 32	
APD 240M021 modules, 240 characters 33	
APD-240M021, modules, 240 characters 33	
APD-240M026A, modules, 240 characters 33	34
APD-240M026A-1, modules, 240 characters 33 APD-250M060, monitors, 250 characters 33	36
APU-25UMU6U, monitors, 250 characters 33	58
APD-256M025A, modules, 256 characters 34	

APD-256M025A-1, modules, 256 characters 342 APD-256M026, modules, 256 characters 344 APD-256M026-1, modules, 256 characters 348 APD-336M019/-2, modules, 336 characters 348 APD-480M021-1, modules, 480 characters 350 APD-480M021/-2, module, 480 characters 352 APD-480M021-5, modules, 480 characters 354 APD-480M021-5, modules, 480 characters 355 APD-480M021-5, modules, 480 characters 356 SAYWHAT?1*, screen generator software 357 PDS-30/1/2, EGA/CGA, controller cards 358 TIP, infrared touch panels, with controller 360 PBG, dual linear bar graphs 363 PBG-C, linear bar graphs 368 ABG-12205, bar graph modules 370 PD-04A200, alphanumeric, 4 characters 372 PD-16A040, aphanumeric, 16 characters 374 PD-32A025, alphanumeric, 32 characters 376 Military Product Identification 378 Packaging 380
Surface Mount Index
Clock Oscillators - Phone: (602) 967-7874 XOSM-52B, BE, hybrid crystal4
Trimmers and Potentiometers
Phone: (602) 967-7874 ST-22, -23, chip potentiometers 16 ST53YJ, YL, cermet trimmers 18 ST63Y, Z, cermet trimmers 20
Wirewound Resistors Phone: (402) 563-6506
WSC, precision, power 61 CPSM, commercial, power 74 CP-2M, special purpose 86
Film Resistors Phone: (402) 371-0080, Dale Phone: (301) 739-8722, Angstrohm
TNPWM, thin film chip, E-Rel, MIL-R-5534291 TNPW, thin film chip, industrial, precision92 SMM0204, thin film cylindrical chip, (MELF)93 Thick Film Chip Resistor Design Kit94 CRCW0603, thick film chip, industrial95 CRCW, thick film chip, industrial96 RC, RCWP, RCW, thick film chip, industrial98 RCM, RCWPM, RCWM, thick film chip, E-Rel, MIL-R-55342
Thick Film Resistor Networks Phone: (402) 371-0080
SOGC, small outline, molded, DIP
NTC Thermistors Phone: (818) 781-1642 Dale, Techno Division Phone: (915) 592-3253 Dale
7, 8, hybrid chip 190 W, chip 206 NTHS, chip 207 J, chip 208
Inductors - Phone: (605) 665-9301
IMC-1210, molded
ISC-1812, molded, shielded
Surface Mount Inductive Components 251

APD-192G096, graphics display modules 324
APD-222G007, graphics display modules 326
APD-240G120, graphics display modules 328
APD-240M019, display modules
APD-240M021, display modules
APD-240M026A, display modules
APD-240M026A-1, display modules
APD-250M060, monitors, (displays)
APD-256M025A, display modules
APD-256M025A, display modules
APD-256M026, display modules
APD-256M026-1, display modules
APD-336M019/-2, display modules
APD-480M021-1 , display modules
APD-480M021/-2, display modules352
APD-480M021-5, display modules354
B, H, D, G, carbon film resistors140
CA, wirewound resistors72
CA-1, -2, wirewound resistors73
CA-(X)F, fuse resistors, axial leads81
CCF-07, metal film resistors100
CCF-50, -55, -60, metal film resistors
CJ, CH, MF, E-Rel, MIL-R-55182, RNC & RNR 118
CMF, metal film resistors 104
CMF, metal film resistors
MIL-R-22684, RL
CMF-55-39, CMF-60-64, metal film resistors 130
CMH-55-100, metal film resistors
CP, wirewound resistors, axial leads
CP-(X)F, fuse resistors, axial leads
CP-2M, surface mount wirewound resistors
CPCL/CC/CP/CF, WW resistors, vertical mount76
CPF, metal film resistors, flameproof
CPL, wirewound resistors, MIL-R-49465,
RLV and commercial, axial leads77
CPR, wirewound resistors, radial terminals79
CPR-(X)F, fuse resistors, radial terminals
CPSL, wirewound resistors, MIL-R-49465,
RLV and commercial, four leads78
CPSM, surface mount wirewound resistors74
CPW, wirewound resistors, axial leads80
CRCW, thick film chip resistors96
CRCW0603, thick film chip resistors95
CSC, resistor networks148
CSRC, resistor/capacitor networks
CT, C, FP, MF resistors, MIL-R-22684, RL 126
Custom Magnetic Components250
Custom Networks
CW, wirewound resistors70
CW, miniature wirewound resistors71
DFM14, resistor networks, MIL-R-83401
DFP14, DFP16, resistor networks
DSEB, D-sub/edgeboard hybrid connectors 296
E08C, E10C, E15C, cermet trimmers
EB4, edgeboard connectors
EB4, EB6, EB7, EB8, hi-temp connectors272
EB6, edgeboard connectors
EB7D, edgeboard connectors
EB7S, edgeboard connectors
EB8, edgeboard connectors
EBT156, edgeboard connectors
ERC, MF resistors, E-Rel, MIL-R-55182, RNC 116
ERH/NH, WW res., E-Rel, MIL-R-39009, RER 50

HL, industrial power wirewound resistors	66
HLA, industrial power wirewound resistors	
HLM, industrial power wirewound resistors	
HLT, industrial power wirewound resistors	
HLW, industrial power wirewound resistors	67
HLZ, industrial power resistors HN, MF resistors, E-Rel, MIL-R-39017, RLR	67
HN, MF resistors, E-Rel, MIL-R-39017, RLR	115
HN, HS, HT, HY, metal film resistors, E-Rel,	
MIL-R-55182, RNR and RNN, herm seal	120
HVW, MVW, HVX, metal alloy resistors	
IH, high current, filter inductors	
IHA, high current, filter inductors	
IHB, high current, filter inductors	
IHD, high current, filter inductors	
IHM-2, high current, filter inductors	248
IHV, high current, filter inductors	249
IM, inductors, MIL-C-15305	
IMC-1210, surface mount inductors	230
IMC-1812, surface mount inductors	231
IMS-2, inductors, MIL-C-15305	236
IMS-5, inductors, MIL-C-15305	234
IR, inductors	240
IRF, inductors	242
IS, surface mount inductors	233
ISC-1812, surface mount inductors	232
J, surface mount chip thermistors	202
25-25-25 (C)	
LVR-1, -3, -5, wirewound resistors, MIL-R-49465, RLV and commercial	-
MIL-R-49465, RLV and commercial	62
LVR-10, wirewound resistors,	
MIL-R-49465, RLV32 and commercial	63
M83401, resistor networks, MIL-R-83401	162
M83401, resistor networks, MIL-R-83401	162 168
M83401, resistor networks, MIL-R-83401	162 168 170
M83401, resistor networks, MIL-R-83401	162 168 170 155
M83401, resistor networks, MIL-R-83401	162 168 170 155 158
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks	162 168 170 155 158
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MDRC, resistor/capacitor networks	162 168 170 155 158 184
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MDRC, resistor/capacitor networks	162 168 170 155 158 184
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial	162 168 170 155 158 184
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt	162 168 170 155 158 184 297 .41
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt	162 168 170 155 158 184 297 .41 .42
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt	162 168 170 155 158 184 297 .41 .42 .43
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt	162 168 170 155 158 184 297 .41 .42 .43
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt	162 168 170 155 158 184 297 .41 .42 .43 .44
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 300 watt	162 168 170 155 158 184 297 .41 .42 .43 .44 .45
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 300 watt	162 168 170 155 158 184 297 .41 .42 .43 .44 .45
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 1164
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 1164
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, resistor networks, MIL-R-83401 MSM, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks ME, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .164 152 124 .65
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MSP, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN MHL, industrial power wirewound resistors NTC Thermistor Assemblies	162 168 170 155 158 184 297 41 42 43 44 45 46 164 152 124 65 219
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP10, rheostats, 12.5 watt MP10, rheostats, 50 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 124 .65 219 218
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSM, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .164 1152 1124 .65 218 229
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP10, rheostats, 12.5 watt MP10, rheostats, 50 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .164 1152 1124 .65 218 229
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 100 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks, MIL-R-10509, RN NF, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 124 .65 219 218 209 210
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP15, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 100 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks MSH, resistor networks NTC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 14	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 112 219 218 209 210 211
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP93, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP40, rheostats, 300 watt MP5, resistor networks, MIL-R-83401 MSP, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, surface mount chip thermistors	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 112 219 2219 2210 2211 207
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP25, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 150 watt MP50, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 100 watt MSM, resistor networks, MIL-R-83401 MSP, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .164 1152 1124 .65 219 2218 2219 2210 .10
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSN, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers P16, PA16, panel controls, "Pot in the Knob"	162 168 170 155 158 184 297 41 42 43 44 45 219 218 209 210 211 207 10
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP30, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 160 watt MP40, rheostats, 100 watt MP5, resistor networks, MIL-R-83401 MSM, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 2 NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers P16, PA16, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays	162 168 170 155 158 184 297 41 42 43 44 45 46 164 152 124 65 219 210 10 11 12 12 10 10 11 15 15 15 15 15 15 15 15 15 15 15 15
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP93, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP80, resistor networks, MIL-R-83401 MSM, resistor networks, MIL-R-83401 MSP, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 2 NTHD, uncoated disc thermistors, curve 1 NTHD, surface mount chip thermistors P11, PA11, cermet potentiometers P16, PA16, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays PBG-C, linear bar graph displays	162 168 170 155 158 184 297 41 42 43 44 45 46 164 152 124 65 219 210 14 363 368
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDP16-45, -46, resistor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 100 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSM, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers P16, P416, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays PD-04A200, alphanumeric displays	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 112 219 210 211 .207 .10 .14 .13 .16 .16 .16 .16 .17 .17 .17 .17 .17 .17 .17 .17 .17 .17
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 25 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 150 watt MP30, rheostats, 150 watt MP40, rheostats, 150 watt MP40, rheostats, 160 watt MP40, rheostats, 100 watt MP5, resistor networks, MIL-R-83401 MSM, resistor networks NE, NC, CT, NA, MF resistors, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 2 NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers P16, PA16, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays	162 168 170 155 158 184 297 .41 .42 .43 .44 .45 .46 164 152 112 219 210 211 .207 .10 .14 .13 .16 .16 .16 .16 .17 .17 .17 .17 .17 .17 .17 .17 .17 .17
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDRC, resistor/capacitor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP93, rheostats, 100 watt MP30, rheostats, 150 watt MP40, rheostats, 300 watt MP80, resistor networks, MIL-R-83401 MSP, resistor networks, MIL-R-83401 MSP, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 1 NTHD, uncoated disc thermistors, curve 14 NTHD, surface mount chip thermistors P11, PA11, cermet potentiometers P16, PA16, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays PBG-C, linear bar graph displays PD-04A200, alphanumeric displays PD-04200, alphanumeric displays	162 168 170 155 158 184 297 41 42 43 44 45 46 164 152 124 65 219 210 211 207 10 11 13 168 183 184 184 195 195 195 195 195 195 195 195 195 195
M83401, resistor networks, MIL-R-83401 M8340101, M8340102, resistor networks MDM14, 16, resistor networks, MIL-R-83401 MDP14, 16, 18, resistor networks MDP16-45, -46, resistor networks MDP16-45, -46, resistor networks MM22, MM24, rack and panel connectors MIL-C-28748 and commercial MP06, rheostats, 12.5 watt MP10, rheostats, 50 watt MP10, rheostats, 50 watt MP25, rheostats, 100 watt MP30, rheostats, 100 watt MP40, rheostats, 300 watt MSM, resistor networks, MIL-R-83401 MSM, resistor networks, MIL-R-10509, RN NHL, industrial power wirewound resistors NTC Thermistor Assemblies NTC Thermistors, curve track/point match NTHD, uncoated disc thermistors, curve 1 NTHS, surface mount chip thermistors P11, PA11, cermet potentiometers P16, P416, panel controls, "Pot in the Knob" PBG, dual linear bar graph displays PD-04A200, alphanumeric displays	162 168 170 155 158 184 297 41 42 43 44 45 46 164 152 124 65 219 210 211 207 10 11 13 168 183 184 184 195 195 195 195 195 195 195 195 195 195

RDX, metal oxide resistors, ratio dividers 142
RH, NH, wirewound resistors, MIL-R-18546, RE 52
RJ24 , cermet trimmers, MIL-R-2209732
RJ26, cermet trimmers, MIL-R-2209734
RJR24, cermet trimmers, E-Rel, MIL-R-39035 32
RJR26, cermet trimmers, E-Rel, MIL-R-39035 34
RJU, metal oxide resistors142
RNX, metal oxide resistors, high voltage
ROX, metal oxide resistors, high voltage
RS, wirewound resistors, MIL-R-26, RW58
RS, miniature wirewound resistors60
RS-1F, fuse resistors, molded, custom
RT24, wirewound trimmers, MIL-R-2720836
RT26, 27, WW trimmers, MIL-R-2720838
RTR24, WW trimmers, E- Rel, MIL-R-39015 36
SAYWHAT?!®, screen software, (displays)357
SM20, rack and panel, connectors303
SMA, OMA, metal film resistors, jumper102
ONIA, ONIA, metar min resistors, jumper
SMH, surface mount resistors, (MELF)121
SMM0204, cylindrical chip resistors, (MELF)93
Soft Start, NTC thermistors200
SOGC, surface mount resistor networks
SOMC, surface mount resistor networks146
Special Applications Connectors307
Special Power Rheostats47
Special Purpose Wirewound Resistors85
Special Purpose Wirewounds87
SPR-2213 , -2214 , wirewound resistors86
SPW, carbon film resistors
SSN, NTC thermistors, Soft Start
ST-22, -23, chip potentiometers
CTEQUI VI cormet trimmere quefoce mount 10
ST53YJ, YL, cermet trimmers, surface mount 18
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 28 TA, audio, telephone coupling transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 28 TA, audio, telephone coupling transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 28 TA, audio, telephone coupling transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors E-Rel,
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 28 TA, audio, telephone coupling transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors E-Rel,
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 TG, converter trimmers, small size 28 TA, audio, telephone coupling transformers 256 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 92 TNPWM, thin film chip resistors, E-Rel, MIL-R-55342, RM 91 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 TYYA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 TG, converter transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 92 TNPWM, thin film chip resistors 92 TNPWM, thin film chip resistors E-Rel, MIL-R-55342, RM 91 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24 TxxS, R/2R ladder networks 187
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 TG, converter trimmers, small size 26 TC, converter trimmers, small size 26 TCO6, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 71 TNPWM, thin film chip resistors, E-Rel, MIL-R-55342, RM 91 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24 TxxS, R/2R ladder networks 187 W, surface mount chip thermistors 206 WSC, surface mount by thermistors 214 X, M, C, F, T, B, NTC thermistors 214
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 TG, converter trimmers, small size 26 TC, converter trimmers, small size 26 TCO6, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 71 TNPWM, thin film chip resistors, E-Rel, MIL-R-55342, RM 91 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24 TxxS, R/2R ladder networks 187 W, surface mount chip thermistors 206 WSC, surface mount by thermistors 214 X, M, C, F, T, B, NTC thermistors 214
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 TYYA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 T03, cermet trimmers, small size 26 T04, audio, telephone coupling transformers 256 TC, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Tlip, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 92 TNPWM, thin film chip resistors 92 TNPWM, thin film chip resistors, E-Rel, MIL-R-55342, RM 91 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24 TxxS, R/2R ladder networks 187 W, surface mount chip thermistors 206 WSC, surface mount wirewound resistors 61 X, M, C, F, T, B, NTC thermistors 214 XO-43B, crystal clock oscillators 5
ST53YJ, YL, cermet trimmers, surface mount
ST53YJ, YL, cermet trimmers, surface mount 18 ST63Y, Z, cermet trimmers, surface mount 20 Surface Mount Inductive Components 251 T7YA, YB, cermet trimmers, miniature 22 T14L10, R/2R ladder networks 188 T16L08, T16LR8, R/2R ladder networks 189 T18, T18T, cermet trimmers, rectangular 30 T63, cermet trimmers, small size 26 T93, cermet trimmers, small size 26 T63, cermet trimmers, small size 26 T64, audio, telephone coupling transformers 256 TC6, converter transformers 265 TC06, NTC thermistors, MIL-T-23648 198 TCN, capacitor networks 186 TE, TD, filter inductors, toroids 252 Temperature Sensing Probes 204 Thick Film Chip Resistor Design Kit 94 TIP, infrared touch panels, (displays) 360 TNPW, thin film chip resistors 360 TNPW, thin film chip resistors 37 TNPWM, thin film chip resistors 39 TR, TD, thick film, resistors and dividers 143 TR, TD, thick film, resistors and dividers 143 TRC, resistor/capacitor networks 178 TX, TXD, TY, cermet trimmers, miniature 24 TxxS, R/2R ladder networks 187 W, surface mount chip thermistors 206 WSC, surface mount wirewound resistors 214 XO-52B, BD, BE, crystal clock oscillators 7
ST53YJ, YL, cermet trimmers, surface mount

MODELS XOSM-52B and XOSM-52BE **Clock Oscillators**

A COMPANY OF VISHA DALE

Hybrid Crystal, Surface Mount 240 Hz to 72 MHz (-52B), 500 KHz to 40 MHz (-52BE)



FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- · Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C.

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging,

shock and vibration): ±.01% (± 100PPM).

Input Voltage (Vdd): $+5.0 \pm 0.5$ VDC.

Input Current: 5 to 50 mA typical (see table).

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.1 Vdd maximum CMOS, 0.4 V maximum TTL.

Logic '1' Level: 0.9 Vdd minimum CMOS, 2.4 V minimum TTL.

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible, waveform symmetry. (0.5 Vdd CMOS

or 1.4 V TTL levels): $50 \pm 10\%$.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum. Disable Input Voltage: 0.8 V maximum. Enable Input Current: 10 µA maximum. Disable Input Current: 300 µA maximum.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than

2 x 10⁻⁸ atmosphere cc/sec. of helium. Marking Ink: Epoxy, solvent resistant. Solvent Resistance: Isopropyl alcohol,

trichloroethane, Freon TMC.

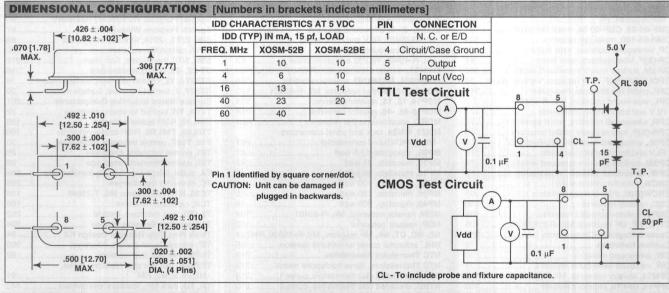
Terminal Solderability: Per MIL-STD-202,

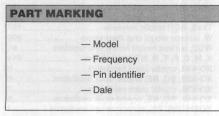
Method 208C.

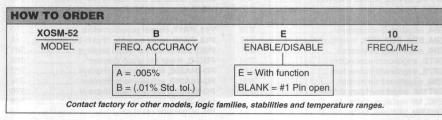
ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle: - 55°C to + 85°C, 3 cycles. Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane.

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz. Humidity: 85% relative humidity at 85°C, 240 hours.







MODEL XO-43B Clock Oscillators







FEATURES

- · Able to withstand flow soldering
- Wide range of standard frequencies available from stock (listed below)
- · Hermetically sealed package
- Low profile .225" [5.72] maximum seating height
- Metal Case corrosion resistant and grounded for EMI shielding
- · Glass standoffs for spacing from mounting surface

FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY AT 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
250 KHz to 3.999 MHz	65 max.	55/45	15 nS max.	0.4 volts max.	2.4 volts min.
4.0 MHz to 24.999 MHz	40 max.	60/40*	10 nS max.	0.4 volts max.	2.4 volts min.
25.0 MHz to 60.0 MHz	50 max.	60/40*	6 nS max.	0.4 volts max.	2.4 volts min.

ELECTRICAL SPECIFICATIONS

Input Voltage: + 5 VDC ± 0.5 V.

Frequency Range: 250 KHz to 60 MHz.

Operating Temperature Range: 0°C to 70°C.

TTL Compatible: Will drive 1-10 TTL Gates.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10-8

atmosphere cc/sec. of helium.

Marking Ink: Epoxy, solvent resistant.

Solvent Resistance: Isopropyl alcohol, Trichloroethane,

Freon TMC.

Terminal Solderability: Per MIL-STD-202, Method 208C.

Package: Cold Rolled Steel (CRS), Nickel-Plated Base with

Resistance Welded Stainless Steel Cover.

ENVIRONMENTAL SPECIFICATIONS

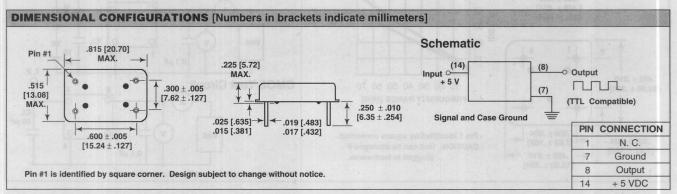
Temperature Cycle: - 55°C to + 85°C, 3 cycles. **Shock:** 1000 G's 0.35 millisecond, 1/2 sine wave,

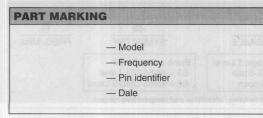
3 shocks each plane.

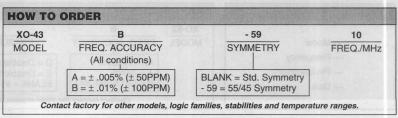
Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz. **Humidity:** 85% relative humidity at 85°C, 240 hours.

STOCKING FREQUENCIES (MHz) "B" accuracy only

1.0	4.9152	10.0	19.6608	32.0
1.2288	5.0	12.0	20.0	40.0
2.0	5.0688	16.0	24.0	50.0
2.4576	6.0	16.384	25.0	
4.0	8.0	18.432	30.0	







MODELS XO-52B, XO-52BD, XO-52BE Clock Oscillators

A COMPANY OF VISHAY

Hybrid Crystal, 240 Hz to 110 MHz (-52B)
1.0 MHz to 70 MHz (-52BD), 1.0 MHz to 110 MHz (-52BE)



FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- · Enabled output optional
- · Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C.

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging,

shock and vibration): $\pm .01\%$ (± 100 PPM). Input Voltage (Vdd): $+ 5.0 \pm 0.5$ VDC.

Input Current: 5 to 50 mA typical (see graph).

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.5 V maximum CMOS, 0.4 V maximum TTL (Vdd = 5 V).

Logic '1' Level: 4.5 V minimum CMOS, 2.4 V minimum TTL (Vdd = 5 V).

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform Symmetry: 60/40 standard. 55/45 available.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum.

Disable Input Voltage: 0.5 V maximum.

Enable Input Current: 10 μA maximum.

Disable Input Current: 300 μA maximum.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10⁻⁸ atmosphere cc/sec. of helium.

Marking Ink: Epoxy, solvent resistant.

Solvent Resistance: Isopropyl alcohol,

trichloroethane, Freon TMC.

Terminal Solderability: Per MIL-STD-202,

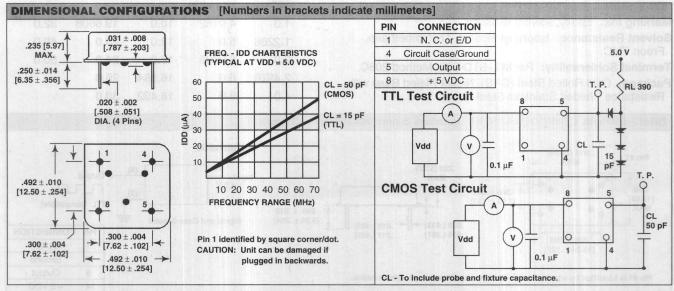
Method 208C.

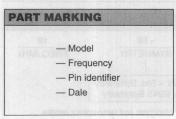
ENVIRONMENTAL SPECIFICATIONS

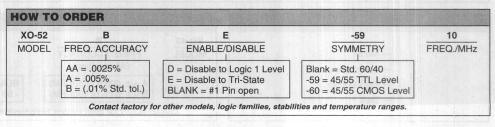
Temperature Cycle: - 55°C to + 85°C, 3 cycles. **Shock:** 1000 G's 0.35 millisecond, 1/2 sine wave, 3

shocks each plane.

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz. **Humidity:** 85% relative humidity at 85°C, 240 hours.







· Glass standoffs for spacing from mounting surface

FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY AT 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
250 KHz to 3.999 MHz	90 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
4.0 MHz to 8.999 MHz	40 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
9.0 MHz to 24.999 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
25.0 MHz to 31.999 MHz	70 max.	60/40	10 nS max.	0.5 volts max.	2.4 volts min.
32.0 MHz to 60.0 MHz	70 max.	60/40	6 nS max.	0.5 volts max.	2.4 volts min.

ELECTRICAL SPECIFICATIONS

Input Voltage: +5 VDC ± 0.5 V.

Frequency Range: 250 KHz to 60 MHz.

Frequency Stability: ± .01% (± 100PPM).

Operating Temperature Range: 0°C to 70°C.

TTL Compatible: Will drive 1-10 TTL Gates.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10⁻⁸ atmosphere cc/sec. of helium.

Marking Ink: Epoxy, solvent resistant.

Solvent Resistance: Isopropyl alcohol, Trichloroethane, Freon TMC.

Terminal Solderability: Per MIL-STD-202, Method 208C.

ENVIRONMENTAL SPECIFICATIONS

Temperature Cycle: - 55°C to + 85°C, 3 cycles.

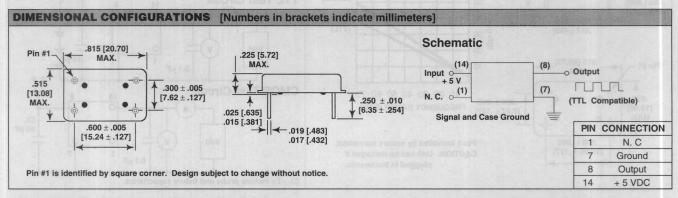
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave,

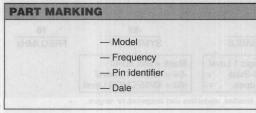
3 shocks each plane.

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz. Humidity: 85% relative humidity at 85°C, 240 hours.

STOCKING FREQUENCIES (MHz)

1.0	4.9152	10.0	19.6608	32.0
1.2288	5.0	12.0	20.0	40.0
2.0	5.0688	16.0	24.0	50.0
2.4576	6.0	16.384	25.0	
4.0	8.0	18.432	30.0	





XO-53	В	10
MODEL	FREQ. ACCURACY (All conditions)	FREQ./MHz
	B = ±.01% (± 100PPM)	

MODELS XO-54B, XO-54BD, XO-54BE Clock Oscillators

Hybrid Crystal, 240 Hz to 110 MHz (-54B)
1.0 MHz to 70 MHz (-54BD), 1.0 MHz to 110 MHz (-54BE)





FEATURES

- . HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to 70°C.

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging, shock and vibration): ±.01% (±100PPM).

Input Voltage (Vdd): $+5.0 \pm 0.5$ VDC.

Input Current: 5 to 50 mA typical (see graph).

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.5 V maximum CMOS, 0.4 V maximum TTL

(Vdd = 5 V).

Logic '1' Level: 4.5 V minimum CMOS, 2.4 V minimum TTL

(Vdd = 5 V).

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform Symmetry: 60/40 standard. 55/45 available.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum.

Disable Input Voltage: 0.5 V maximum.

Enable Input Current: 10 μA maximum.

Disable Input Current: 300 μA maximum.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than

2 x 10⁻⁸ atmosphere cc/sec. of helium. **Marking Ink:** Epoxy, solvent resistant. **Solvent Resistance:** Isopropyl alcohol,

trichloroethane, Freon TMC.

Terminal Solderability: Per MIL-STD-202, Method

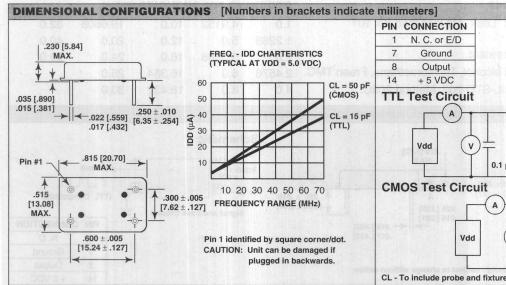
208C.

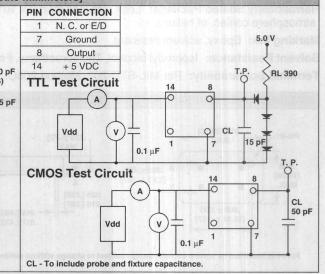
ENVIRONMENTAL SPECIFICATIONS

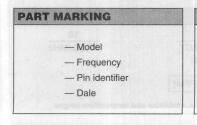
Temperature Cycle: - 55°C to + 85°C, 3 cycles. **Shock:** 1000 G's 0.35 millisecond, 1/2 sine wave, 3

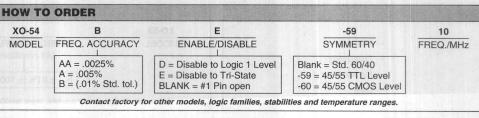
shocks each plane.

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz. **Humidity:** 85% relative humidity at 85°C, 240 hours.









MODELS E08C, E10C, E15C Cermet Trimmers



Miniature, Industrial Grade, Singleturn Open Frame, Ceramic Construction

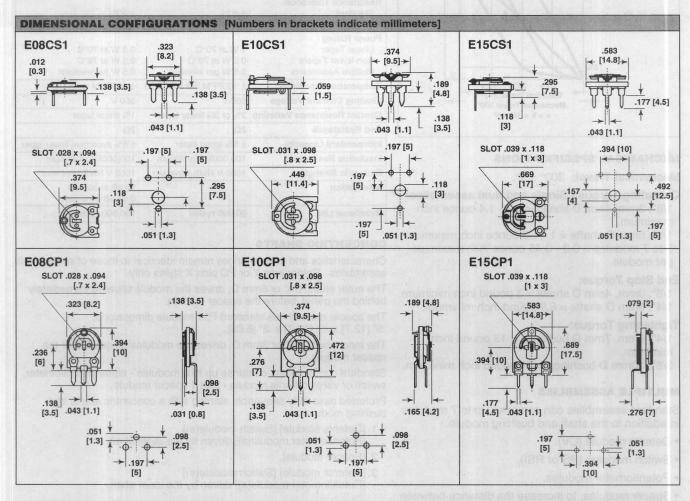


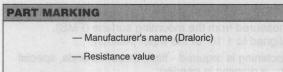
FEATURES

- Adjustable top + bottom or front + back
- Durable ceramic and metal construction
- · Low profile

MECHANICAL S	PECIFICATI	ONS	
MODEL	E08C	E10C	E15C
Mechanical Travel	240	240	260
Operating Torque	.3-1.5 cmN	.4-2 cmN	.5-2.5 cmN
Weight (Grams)	.4	.8	2.3

STAND	ARD ELECTR	ICAL SP	ECIFICAT	rions							
	RESISTANCE RANGE	TOLENANCE		POWER RATING	TE	TEMPERATURE COEFFICIENT			- TEMPERATURE		
MODEL	(Ohms)	10Ω-47Ω	22Ω-47Ω	47Ω-1M	47Ω-2.2M	@70°C	10Ω-47Ω	47Ω-100Ω	100Ω-1M	100Ω-2.2M	LIMITS
E08C	10-1M	± 30%		± 20%		.33W	± 250PPM	± 150PPM	± 100PPM		- 55°C - + 110°C
E10C	10-2.2M	± 30%		<u> </u>	± 20%	.5W	± 250PPM	± 150PPM		± 100PPM	- 55°C - + 110°C
E15C	22-2.2M		± 30%		± 20%	1W	± 250PPM	± 150PPM		± 100PPM	- 55°C - + 110°C



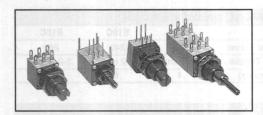


HOW TO ORD	ER			
	E10CS1	10k	20%	
	MODEL	VALUE	TOLERANCE	

MODELS P11 and PA11 Modular Potentiometers

Cermet/Conductive Plastic Element





FEATURES

- Miniature module size .5" [12.7] x .5" [12.7] x .2" [5.08]
- Shaft diameters 1/4", 1/8", 3mm, 4mm, 6mm
- · Up to seven modules as standard
- · P.C. pins or solder lugs
- P.C. mounting brackets
- · Up to twenty-one detents
- Rotary switch modules
- Concentric shafts
- Motorized designs
- Custom designs

APERS			
90%	F/B	M	
Vs Ve % 50%	//	1	
10%	25% 50%		В
***************************************	Electrical Tra Mechanical Tra α = β = 15	vel 270° →	

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 5°.

Operating Torque - Single and dual assemblies: 1/8", 3mm, 4mm D shafts = 0.7 - 1.4 ounce inch

maximum

1/4", 6mm D shafts = 1 - 1.9 ounce inch maximum. 3 to 7 modules = 0.3 - 0.45 ounce inch maximum per module.

End Stop Torque:

1/8", 3mm, 4mm D shafts = 3 pound inch minimum. 1/4", 6mm D shafts = 6.8 pound inch minimum.

Tightening Torque:

1/4", 6mm, 7mm D bushings = 13 pound inch

3/8", 10mm D bushings = 21 pound inch minimum.

MULTIPLE ASSEMBLIES

Standard assemblies can comprise up to 7 modules in addition to the shaft and bushing module.

- · Detents module (CV).
- · Switch modules (RS or RSI).
- · Potentiometer modules.
- Spacer modules, to increase the distance between rows of pins from .2" [5.08] to .4" [10.16].
- · Screening module, with ground terminal.

Preferred assembly sequence, not mandatory: [Shaft and bushing module] [Detents module] [Switch module(s)] [Potentiometer module(s)].

	P11 (Cermet)	PA11 (Conductive Plastic)
Electrical Travel	270° ± 10°	270° ± 10°
Resistance Range	20Ω to $2M\Omega$ - Linear $1k\Omega$ to $1M\Omega$ - Non-linear	500Ω to 200 k Ω - Linear 1k Ω to 1M Ω - Non-linear
Resistance Tolerance Standard On Request	± 10% ± 5%	± 20% ± 10%
Power Rating Linear Taper Non-linear Tapers Multiple Assemblies	1 W at 70°C 0.5 W at 70°C 0.5 W per element	0.5 W at 70°C 0.5 W at 70°C 0.5 W per element
Temperature Coefficient	\pm 100PPM if R > = 100 Ω	± 500PPM typical/C°
Limiting Element Voltage	350 V	350 V
Contact Resistance Variation	2% or 3Ω linear taper	1% linear taper
End Resistance	2Ω	2Ω
Independent Linearity	± 5% linear taper	± 5% maximum linear taper
Insulation Resistance	100,000MΩ minimum	100,000MΩ minimum
Dielectric Strength	1500 V RMS minimum	1500 V RMS minimum
Attenuation	STATE OF THE STATE	90 dB maximum 0.05 dB minimum
Rotational Life	50,000 cycles	100,000 cycles

CONCENTRIC SHAFTS

Characteristics and performances remain identical to those of single shaft assemblies. Solder lugs Y or PC pins X styles only.

The outer shaft, 1/4" or 6mm D, drives the module situated immediately behind the panel, before the spacer module.

The spacer module has standard P11 module dimensions: .5" [12.7] x .5" [12.7] x .2" [5.08].

The inner shaft, 1/8" or 3mm D, drives the modules situated after the spacer module.

Standard combinations comprise up to 6 modules - either potentiometer, switch or valley detents module - plus 1 spacer module.

Preferred assembly sequence, starting with a concentric shafts and bushing module:

- [Detents Module] [Switch module(s)]
 [Potentiometer module(s)] driven by the outer shaft.
- 2. [Spacer module].
- [Detents module] [Switch module(s)]
 [Potentiometer module(s)] driven by the inner shaft.

CUSTOM SHAFTS

Shaft length is measured from the mounting surface (FMS). Shaft slots are aligned to $\pm\,10^\circ$ of the wiper position.

When special machining is required - flats, threaded ends, special shaft lengths, etc., a drawing is needed.

Switch actuation (Cvv direction) makes contact between 1 and 2.

RSIF SINGLE POLE CHANGEOVER

In full CW position, the contact is made between 1 and 2. Switch actuation (CCW direction) makes contact between 2 and 3.

SWITCH SPECIFICATIONS

Switch Actuation Travel: 25°.

Potentiometer Electrical Travel: 240° ± 10°.

Total Mechanical Travel: 300° ± 5°.

Power Rating: 250 V 1 Amp/30 V 1 Amp with resistive load.

Minimum Current/Voltage: 10 mAmp/50 mV. Initial Contact Resistance: 30 Megohm.

Dielectric Withstand Voltage: 1000 V RMS, terminal to terminal.

Rotational Life: 10,000 actuations.

Temperature Range: - 40°C + 85°C.

VALLEY DETENTS

Up to 21 detents positions available. The valley detents mechanism is housed in a standard P11 module, size .5" [12.7] x .5" [12.7] x .2" [5.08].

Count detents as follows: 1 for full CCW position, 1 for full CW position, plus the other positions forming equal resistance increments (linear taper) - not equal angles.

IMPORTANT: Always consult Dale to obtain a sketch indicating the angular distribution of front panel indexes.

LINEARITY

Measured over 90% minimum of actual electrical travel. On request, linearity can be guaranteed to \pm 3% (option J123) or to \pm 2% (option J145), linear taper only.

INTERLINEARITY (Tracking)

It is the maximum deviation between the actual voltage outputs of 2 or more potentiometer modules in the same assembly. It is expressed as a percentage of the total applied voltage, or preferably in dB attenuation.

Interlinearity is measured between 2 potentiometer modules, over 10 to 90% of the total electrical travel.

Linear taper: \pm 0.8 dB typical, \pm 0.42 dB on request. Non linear tapers: \pm 2 dB typical, \pm 0.83 dB on request.

OTHER OPTIONS

Contact Dale Electronics for further details. Many options are available. The following is a selection:

Motorized Potentiometer: The reduced size of P11 multiple assemblies makes them an ideal fit for motorized potentiometer assemblies.

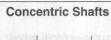
Heavy Duty Trimmer: Bushingless, oversize

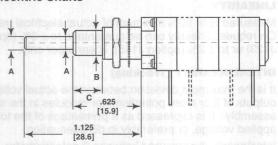
screwdriver slot.

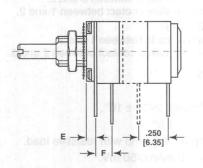
Potentiometer Module Only: For servo applications. Extra Long Rotational Life: To 1 million cycles.

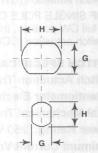
leri ost	P11 (Cermet)*	PA11 (Conductive Plastic)
Shock Total Resistance Shift Resistance Setting Change	50G 11 msecs, 3 shocks, 3 directions 0.2% 0.5% typical	50G 11 msecs, 3 shocks, 3 directions 0.2% 0.5% typical
Vibration Total Resistance Shift Voltage Setting Change	10 - 55Hz/0.75mm or 10G/6 hours 0.2% 0.5% typical	10 - 55Hz/0.75mm or 10G/6 hours 0.2% 0.5% typical
Temperature Cycle Total Resistance Shift	5 cycles, - 55°C to 125°C 0.2%	5 cycles, - 55°C to 125°C 0.5% typical
Rotational Life Total Resistance Shift Contact Resistance Variation	50,000 cycles 3% 5%	100,000 cycles 6% 2%
Load Life Total Resistance Shift Contact Resistance Variation	1,000 hours at 70°C (90' on, 30' off) 2% 4%	1,000 hours at 70°C (90' on, 30' off) 5% 5%
Moisture (40°C - 98% RH) Total Resistance Shift Insulation Resistance	56 days 2% > 1,000MΩ	21 days 5% > 10MΩ
Operating Temperature Range	- 55°C to + 125°C	- 55°C to + 125°C
Climatic Sequence - 5 Cycles Total Resistance Shift	Dry heat + 125°C/ Damp heat/ Cold - 55°C/ Damp heat/ 5 cycles 1%	VS 0

^{*} Above specifications do not apply to values equal to or below 100Ω .









Panel Cutout

Solder lugs Y and PCB pins X only.

The outer shaft (D or VD) drives the module(s) situated immediately behind the panel, before the spacer module. The inner shaft (U or VU) drives the module(s) situated after the spacer.

Terminals (Pin spacings on .1" [25.4] grid unless specified otherwise) X-X2

W1



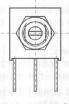




X1



Z



Z2



0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
			0	
0	0	0	0	0









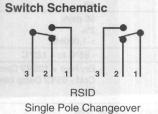


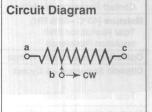
	10		2018	1
0	0	0		-
0			0-	-
.1	50	[3.8]	3] —	1

	SHAFT DIA. DIM. A	BUSHING DIA. DIM. B	BUSHING LENGTH DIM. C	TERMINALS Y, X, X1, X2 DIM. D	DIM. K	TERMINAL Z ONLY DIM. E	TERMINALS Z1, Z2, A, A1, A2 DIM. E	PANEL CUTOUT DIM. G	PANEL CUTOUT DIM. H	NUT WRENCH SIZE
T	[3]	[6]	[8]	[5]	[9.1]	[1.8]	[1.6]	[5.2]	[6.5]	[8]
Q	[4]	[7]	[8]	[5]	[9.1]	[1.8]	[1.6]	[6.2]	[7.5]	[10]
V	[6]	[10]	[9.5]	[7.6]	[11.1]	[3.8]	[3.6]	[8.2]	[10.5]	[12]
CC	[3]/[6]	[10]	[9.5]	[7.6]	-	[3.8]	[3.6]	[8.2]	[10.5]	[12]
7	.125	.250	.250	.200	.357	.071	.063	.244	.295	.314
2	.250	.375	.375	.300	.436	.150	.140	.323	.413	.500
0	.125/.250	.375	.375	.300	_	.150	.140	.323	.413	.500

L, J and pin dimensions determined by part number on the preceding page.

Locating Pegs	OPTION	BUSHING	THICKNESS	R
→ R ←	В	7-T-9	.012	.244
	D	2-V	.031	.531
	С	All	.016	.305



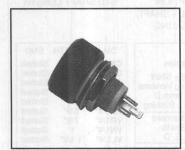


HOW TO ORDER Shaft and Bushing Module BASIC MODULE В3 CK P11 STD SHAFT LENGTH OPTION SHAFT AND BUSHING TERMINAL STYLE OPTION MODEL LOCATING PEG PANEL + SHAFT SEALING Clock Face DIA LENGTH FND **ELEMENTS** BUSH. BUSH. SHAFT Solder Lugs, Radial Orientation 0 No Option Slotted LENGTH DIA. CK1/8" 3/8" DIA X PCB Pins Radial P11 - Cermet B3 Set at 03:00 CM1/8" Slotted 1/2 3/8" 3/8" 1/4" Z PCB Pins, Radial Panel + Shaft PA11 - Conductive Set at 06:00 CD1/8" Slotted 1/4 1/8 Sealing Versions with Front Support Plate Plastic RO Set at 09:00 CH1/8" 3/4" Slotted have 8mm D Metric (mm) A PCB Pins, Radial 7/8 B0 Set at 00:00 CR1/8" Slotted 8mm L Bushing with Front and Back VD1/4" 5/8" Slotted 3 6 8 C3 Set at 03:00 Support Plates Not Standard VR1/4" 7/8" Slotted C6 Set at 06:00 C9 Set at 09:00 with Shafts PCB Pins, Axial with VN1/4" 10 9.5 6 W Slotted K, M, E, D 2 Extra Pin VL1/4" 1 1/2" Slotted C0 Set at 00:00 CONCENTRIC SHAFTS 1 Module Only Other bushing Metric (mm) D3 Set at 03:00 .200" Centers for X, Z, W Pins are .035" x .012" sizes available. 0 3/8" 3/8" 1/8" - 1/4" Set at 06:00 3 9.5 Slotted KMREF consult factory. D9 Set at 09:00 D0 Set at 00:00 3 12.5 Slotted Metric (mm) .100" Centers for X, Z, W Pins are .024" x .012" Slotted 1 22 CC 10 9.5 3-6 Slotted Slotted 4 9.5 Default - No Locating Peg .200" Centers for X, Z, W Pins are .024" x .012" 4 Panel and Shaft Sealing 12.5 2 G Slotted versions have 8mm D and Not available 6 16 Slotted 8mm L Bushing with Panel + .200" Spacing Between Knurled Shaft Sealing Modules NS 6 25 Slotted Option Slotted .300" Spacing Between 50 3 Modules CONCENTRIC SHAFTS 4 .400" Spacing Between D 1/4" 5/8" Plain Modules II 1/8" 36/32" Plain Metric (mm) D 6 16 Plain 28.5 Plain C Custom - Specify or quote drawing Shaft lengths measured from mounting surface P112X24B3PCK RSD J 000 CV1M 20Ω 10% TAPER VALUE BASIC MODULE **OPTION OPTION** TOLERANCE **OPTIONS DETENTS MODULE** SWITCH MODULE(S) Single pole normally open switch in CCW CV1M 1 Detent at Half Travel RSD J 000 Center Tap A Linear Quote in clear 20% Standard using multipliers K, M or use 3 1 Detent in CCW Position Conductive Plastic L CW Log J 084 Improved Accuracy CV1D of Center Point for CV1M F CW CV1F 1 Detent in CW Postion position digit code. 10% Standard Reverse Log CV03 3 Detents inc. CW and CCW Single pole 20Ω - 2ΜΩ for Cermet-J 123 Linearity ± 3% S Audio S CV05 5 Detents normally open switch in CW A Linear Taper: Optional for (Linear Law) Shape Cermet Conductive Plastic CV07 7 Detents Symetrical J 145 Linearity ± 2% position 500Ω - 2MΩ L, F CW Log **CV09** 9 Detents (Linear Law) RSID Single pole and S Non-linear Tapers: 5% Optional for J 116 Interlinearity ± 0.42 dB CV11 11 Detents...(Standard) changeover switch in CCW Cermet J 119 Interlinearity ± 0.83 dB for L, F and S CV13 13 Detents Cermet and Conductive Plastic position CV15 15 Detents Non-linear Laws RSIF Single pole 500Ω - 1ΜΩCV17 17 Detents Torque Compensation changeover A Linear Taper Conductive Plastic EC CV19 19 Detents switch in CW CV21 21 Detents...(Standard) position More options available 0000 No Option 0000 No Option An assembly can The number of detents is always an odd comprise 1 or more number switch modules. Always consult Dale to obtain a sketch Distance between *1ST POTENTIOMETER MODULE indicating the angular distribution of panel indexes - not equal angles. pins .100" or .200" as selected for * If more Potentiometer Modules are desired (there can be up to seven), then repeat Value, Tolerance, Taper and Options potentiometer modules for each. Standard Assemblies can comprise up to 7 modules in addition to shaft and bushing module. See preferred assembly sequence under heading "Multiple Assemblies"

MODELS P16 and PA16 Panel Controls

Miniature, "Pot in the Knob" Cermet/Conductive Plastic

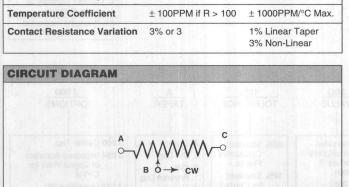




FEATURES

- · Compact, minimum clearance, low profile design
- Fully sealed and panel sealed
- · Easy to specify part type for ordering
- Metal bushing
- · Available through distribution
- · Simple, compact, reliable, available
- Bushing mounted panel control built inside a knob rather than behind a panel

STANDARD ELECTRICAL SPECIFICATIONS				
10 12 FS16000 B (10 FS16000 B (10 FS16000 B (10 FS1600 B	CERMET ELEMENT	CONDUCTIVE PLASTIC ELEMEN		
Resistance Range				
Linear Taper	22Ω-10M	500Ω-100k		
Non-Linear Taper	1k-1M	500Ω-100k		
Tolerance				
Standard	± 10%	± 20%		
Optional	± 5%	± 10%		
Power Rating				
Linear Taper	1 W @ 40°C	.5 W @ 40°C		
Non-Linear Taper	.5 W @ 40°C	.25 W @ 40°C		
Temperature Coefficient	± 100PPM if R > 100	± 1000PPM/°C Max.		
Contact Resistance Variation	3% or 3	1% Linear Taper 3% Non-Linear		



ELECTRICAL SPECIFICATIONS

Electrical Travel: $270^{\circ} \pm 10^{\circ}$. Dielectric Strength: 2500 V.

Limiting Element Voltage: 350 V linear taper.

Insulation Resistance: > 10 Megohm, 500 VDC.

End Resistance: 1 typical.

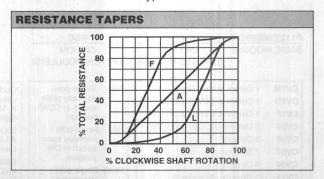
MECHANICAL SPECIFICATIONS

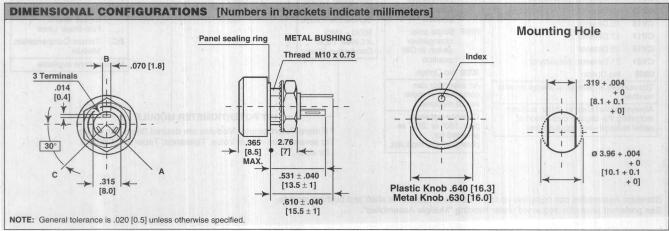
Mechanical Travel: $300^{\circ} \pm 5^{\circ}$.

Operating Torque: 2.8 ounce/inch typical. End Stop Torque: 2 pound/inch typical.

Unit Weight: Plastic knob .17 ounces typical,

metal knob .20 ounces typical.





Vibration Total Resistance Shift Change in Voltage Setting	10-55 Hz/0.75mm or 10g/6 hours 0.1% 0.2%	10-55 Hz/0.75mm or 10g/6 hours 0.2% 0.5%
Temperature Cycles Plastic Knob, 5 cycles Metal Knob, 5 cycles Total Resistance Shift	- 55°C to + 85°C - 55°C to + 85°C 0.5%	- 55°C to + 85°C - 55°C to + 85°C 0.5%
Rotational Life Total Resistance Shift Contact Resistance Variation	25,000 cycles 3% < 2%	25,000 cycles 5% < 2%
Load Life	1000 hours @ 40°C. Cycles 90 min. on, 30 min. off	1000 hours @ 40°C. Cycles 90 min. on, 30 min. off

MOUNTING RECOMMENDATIONS

We recommend a mounting hole be punched in the panel matching the two flats on the bushing. This is to provide a means of anti-rotational support.

Should the mounting hole be round, the bushing (not the knob) should be held by any means while the hex nut is being tightened. Tightening force shall not exceed 21 pounds per square inch. Panel sealing will be achieved at a pressure of 13 pounds per square inch.

The P16 bushing generally fits mounting holes as specified for 3/8 [9.53] diameter bushings.

OPTIONS

A limited variety of colors are available for the plastic knobs. Colors available include black, blue, red and white. Consult the factory for minimums. Consult the factory for color options on the metal knob.

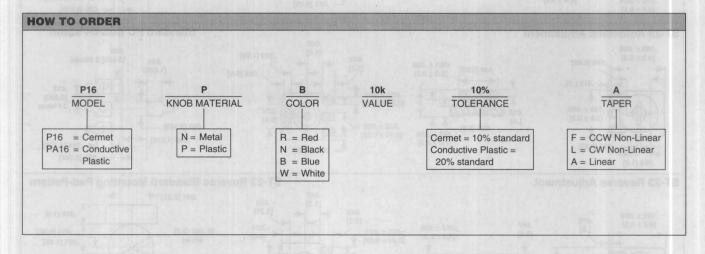
PACKAGING

The P16 is packed in tubes (20 per tube) with the leads protected.

PART MARKING

(on bushing flat)

- Ohmic Value
- Tolerance
- Taper Code



MODELS ST-22 and ST-23 Chip Potentiometers

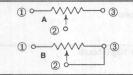
Surface Mounted Single Turn, Open Frame, 4mm Square







EQUIVALENT CIRCUIT



FEATURES

- Designed for efficient, accurate miniaturization
- Can be wave or dip soldered without rotor problems
- Coded marking for easy identification of resistance value
- Models for standard, automatic or reverse adjustment
- · 12mm tape and reel packaging

ELECTRICAL SPECIFICATIONS

Resistance Values: 100 ohm to 1 Megohm.

Resistance Tolerance: ±30%.
Rated Power: 0.2 watt at 70°C.
Rated Voltage: 100 VDC.
Rotation Life: 20 rotations.

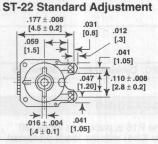
Torque: 20 to 200 g cm.

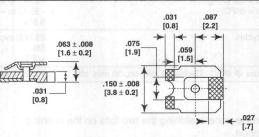
Rotation Angle: 270° ± 20° total.

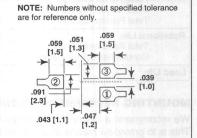
Operating Temperature Range: - 40°C to + 100°C.

TCR: ±250PPM/°C. CRV: 5% maximum.

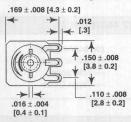
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

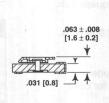


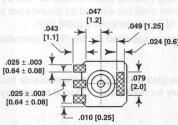




ST-23 Standard Adjustment





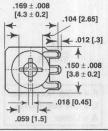


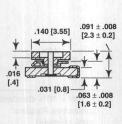
← .084 [2.134]

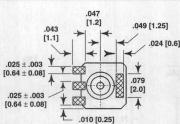
← .020 [0.508]

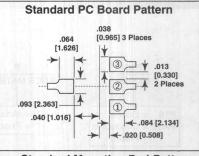
.040 [1.016]

ST-23 Automatic Adjustment

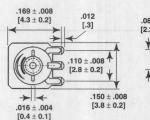


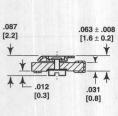


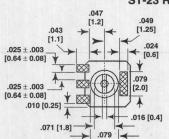


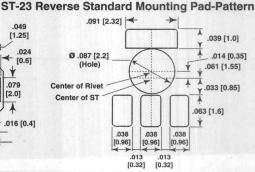


ST-23 Reverse Adjustment





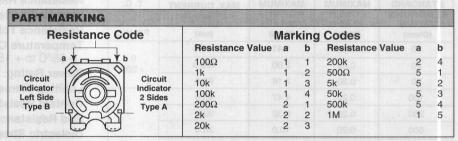


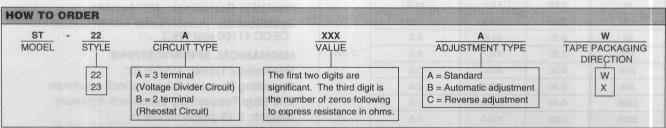


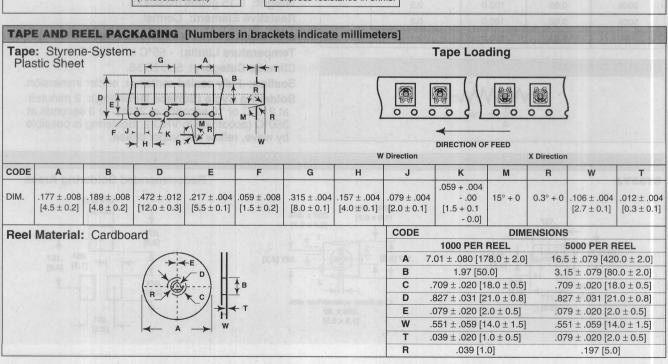
MODELS ST-22 and ST-23

ENVIRONMENTAL PERFORMANCE				
PARAMETER	TEST METHODS	SPECIFICATIONS		
Resistance to Soldering Heat	Set rotor to full value, immerse in SN62 solder bath at 250°C for 5 ± 1 seconds. Stabilize at 25°C for 5 hours. Measure resistance value.	$\Delta R < \pm 1\%$ of initial value		
Vibration	Set rotor to nominal value, frequency 10-55 Hz, amplitude 1.5mm, duration 2 hours in X, Y and Z axis.	$\Delta R < \pm 1\%$ of initial value		
Temperature Cycle	Set rotor to full value 5 cycles from - 40°C to 25°C. Dwell for 30 minutes at - 40°C and + 100°C. Dwell 15 minutes at 25°C. Stabilization time is 1 hour each.	$\Delta R < \pm 2\%$ of initial value		
Heat Resistance	Set rotor to full value, bake at + 100°C for 250 hours, stabilize at 25°C for 1 hour prior to taking final measurements.	$\Delta R < \pm 3\%$ of initial value		
Rotation Life (Resistance)	Rotate 20 times through 90% of effective rotation angle at a rate of 10 rotations per minute.	$\Delta R < \pm 15\%$ of initial value		
Rotation Life (Torque)	Rotate rotor 10 times through 270° arc. Measure torque after 5 and 10 rotations.	Torque to be 20 g cm-200 g cm		
Load Life	Set rotor to full value, test temperature + 70°C ± 2°C, cycle voltage on for 90 minutes, off for 30 minutes for 1000 hours. Stabilize at 25°C for 1 hour. Measure resistance value.	$\Delta R < \pm 3\%$ of initial value		
Load Life in Moisture	Set rotor to full value, test temperature + 40°C ± 2°C at 90-95% RH. Cycle voltage on for 90 minutes, off for 30 minutes for 500 hours. Stabilize at 25°C for 1 hour. Measure resistance value.	$\Delta R < \pm 3\%$ of initial value		
Solvent Resistance	Set rotor to full value, immerse in Trichloroethylene or equivalent for 15 minutes. Air dry at 25°C for 5 hours. Measure resistance value.	$\Delta R < \pm 1\%$ of initial value		

STANDARD RESISTANCE VALUES				
Ohms	Ohms	Ohms		
100	5k	200k		
200	10k	500k		
500	20k	1M		
1k 8 %	50k			
2k	100k			







MODELS ST53YJ and ST53YL Cermet Trimmers

Surface Mount, Miniature, Single Turn, Fully Sealed

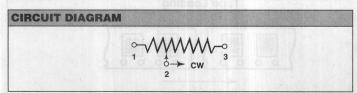




FEATURES

- 0.2 watts at 85°C
- Excellent stability
- Wide ohmic range
- Fully sealed
- · Low temperature coefficient
- Low contact resistance variation
- · Manual or automatic operations
- Small size for optimum packing density

		LINEAR LAW			
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C	
10	0.20	1.41	141.0		
20	0.20	2.00	100.0	0 + 200	
50	0.20	3.16	63.0	out of	
100	0.20	4.47	45.0	62.5	
200	0.20	6.32	32.0	met 1	
500	0.20	10.0	20.0		
1k	0.20	14.1	14.0		
2k	0.20	20.0	10.0		
5k	0.20	31.6	6.3	100	
10k	0.20	44.7	4.5	± 100	
20k	0.20	63.2	3.2	ens atio	
50k	0.20	100.0	2.0	gio dairit a	
100k	0.10	100.0	1.0	alfor duries,	
200k	0.05	100.0	0.5	of consta	
500k	0.02	100.0	0.2		
1M	0.01	100.0	0.1		



APPLICATIONS

The ST53 trimming potentiometers have been designed for surface mount applications. They offer volumetric efficiency and have dimensions of .197" x .197" x .106" [5.0 x 5.0 x 2.7] with high performance and stability.

The ST53 models are suitable for both manual or automatic operation and can withstand wave, vapor phase and reflow soldering techniques.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 220° ± 15°.

Resistance Range: 10 ohm to 1 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 20% standard.

Temperature Coefficient: ± 100PPM/°C
(- 55°C to + 155°C) for Rn ≥ 100 ohm.

Power Rating: 0.2 watt at + 85°C. Limiting Element Voltage: 200 V.

Contact Resistance Variation: 1% Rn or 3 ohm.

End Resistance Variation: 1 ohm typical. Dielectric Strength: 1000 V RMS.

Insulation Resistance: 10⁶ Megohm.

Specification: In accordance with NFC 83251 or

CECC 41100 and VRCI.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 270° ± 10°.

Operating Torque: 2.2 ounce inch maximum. End Stop Torque: 5.0 ounce inch minimum.

Weight: 0.15 grams maximum. **Resistive Element:** Cermet.

ENVIRONMENTAL SPECIFICATIONS

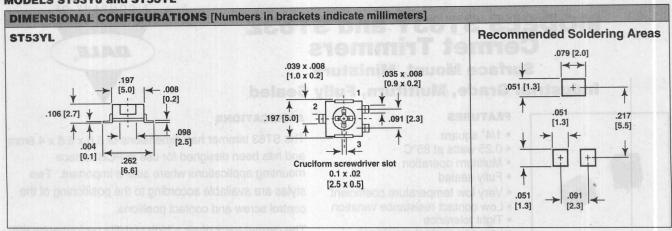
Temperature Limits: - 55°C to + 155°C.

Climatic Category: 55/125/56.

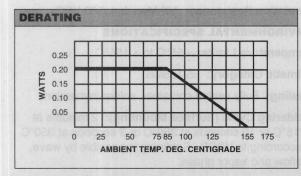
Sealing: Fully sealed container, solder immersion. Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering is possible

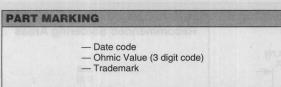
by wave, reflow and vapor phase.

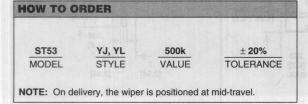
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] ST53YJ **Recommended Soldering Areas** .079 [2.0] .035 x .008 [1.0 x 0.2] [0.9 x 0.2] [5.0] .079 + [2.0] .106 [2.7] [5.0] .051 .091 [2.3] .157 + [1.3] [4.0] .098 .004 .079 [0.1] Cruciform screwdriver slot [5.5] [2.5 x 0.5] 091 [2.3]

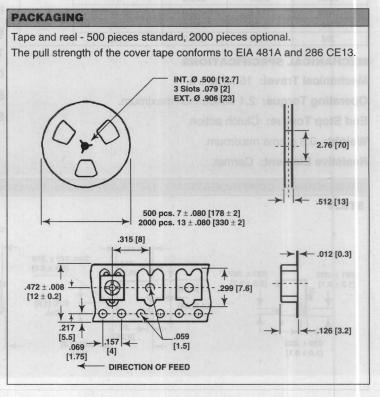


ENVIRONMENTAL PERFORMANCE						
		TYPICAL VALUES AND DRIFTS				
TEST'	CONDITIONS	ART RT	%	MINNYAN	∆R1-2 R1-2 %	
Thermal Shock	5 cycles, - 55°C to + 125°C	1%	WORKING	POWER AT 88°C	Δ <u>V1-2</u> 2% V1-3	
Moisture Resistance (106)	stance (106) 10 cycles of 24 hours constituted with damp heat-cold-vibrations Dielectric strength Insulation resistance		(22809) 25.0	3% 1000 V RMS 10 ⁴ M		
Long Term Damp Heat	Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	2% Dielectric strength Insulation resistance		0.25 0.25	3% 1000 V RMS 10 ⁴ M	
Shock	3 successive shocks, in 3 directions, 100g, 6 ms	1%	211	0.25	Δ <u>V1-2</u> 1% V1-3	
Vibration	20g, 12 hours, 10 - 55 Hz	1%	28.3	85.0	Δ <u>V1-2</u> 1% V1-3	
Rotational Life (electrical and mechanical)	100 cycles at rated power	3%	35.3 90.0	0.26	XII.	
Load Life	1000 hours at rated power, 90"/30" ambient temperature + 85°C	2% Conta	ct resistance varia	ation	3% < 1% RN	
* Numbers in parenthesis refer to test n	nethod of MIL-STD-202 as modified by the detail specification.	a.	158.0	- 0.25	x(00)	





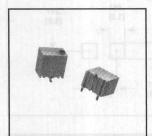




MODELS ST63Y and ST63Z Cermet Trimmers

Surface Mount, Miniature Industrial Grade, Multiturn, Fully Sealed





FEATURES

- 1/4" square
- 0.25 watts at 85°C
- Multiturn operation
- · Fully sealed
- · Very low temperature coefficient
- Low contact resistance variation
- Tight tolerance
- · Low end contact resistance
- Tape and reel or tube packaging

Total Malland		LINEAR LA	w	
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.25	1.58	158.0	
20	0.25	2.23	112.0	+ 200
50	0.25	3.53	77.0	1 200
100	0.25	5.00	50.0	
200	0.25	7.07	35.0	200
500	0.25	11.2	22.0	mer guer.
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	
10k	0.25	50.0	5.0	+ 100
20k	0.25	70.7	3.5	100
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	do techtina
200k	0.25	223.0	1.1	
500k	0.13	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.03	250.0	0.12	or one e

MECHANICAL SPECIFICATIONS

Mechanical Travel: 15 turns ± 5.

Operating Torque: 2.1 ounce inch maximum.

End Stop Torque: Clutch action.
Weight: 0.5 grams maximum.
Resistive Element: Cermet.

APPLICATIONS

The ST63 trimmer has dimensions of 6.6 x 6.8 x 4.6mm and has been designed for use in PCB surface mounting applications where size is important. Two styles are available according to the positioning of the control screw and contact positions.

The cermet track gives a high stability performance with an extended ohmic capacity of 10 ohm to 2 Megohm.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 13 turns ± 2.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

Temperature Coefficient: ± 100PPM/°C (- 55°C to + 155°C) for Rn ≥ 100 ohm.

Power Rating: 0.25 watt at + 85°C. Limiting Element Voltage: 250 V.

Contact Resistance Variation: 2% Rn or 2 ohm,

whichever is greater.

End Resistance Variation: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

Insulation Resistance: 106 Megohm, 500 VDC.

ENVIRONMENTAL SPECIFICATIONS

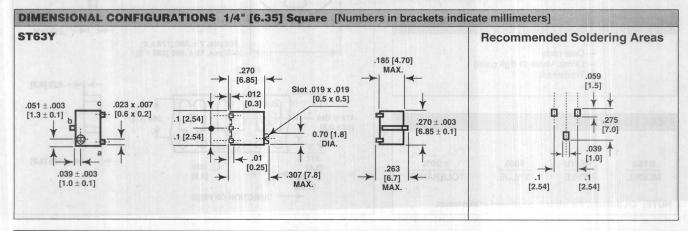
Temperature Limits: - 55°C to + 155°C.

Climatic Category: 55/125/56.

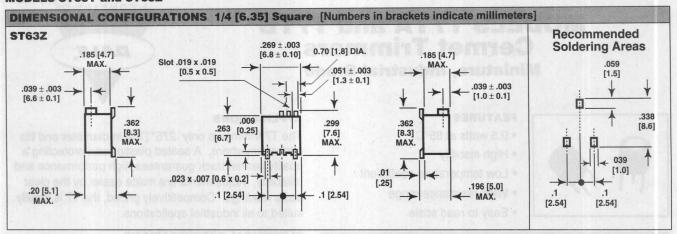
Sealing: Fully sealed container, solder immersion.

Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering is possible by wave,

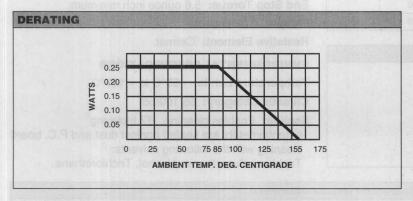
reflow and vapor phase.

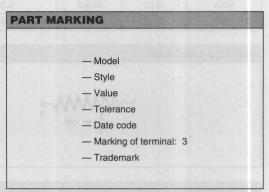


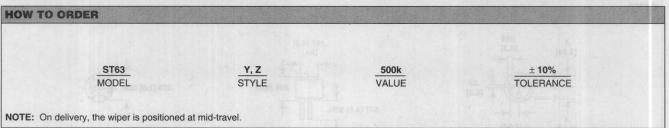
MODELS ST63Y and ST63Z



ENVIRONMENTAL PERF			TYPICAL	L VALUES AND	DRIFTS
TEST'	CONDITIONS		ART %	L VALUES AND	∆R1-2 R1-2 %
Thermal Shock	5 cycles, - 55°C to + 125°C	0.45	0.5%	08.0	Δ <u>V1-2</u> 1% V1-3
Moisture Resistance (106)	10 cycles of 24 hours constituted with damp heat-cold-vibrations	0.00	1% Dielectric strength Insulation resistance	08.0	2% 1000 V RMS 10 ⁴ M
Long Term Damp Heat	Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	0.08	1% Dielectric strength Insulation resistance	0.50	2% 1000 V RMS 10 ⁴ M
Shock	3 successive shocks, in 3 directions, 100g, 6 ms	0.88	1%	osq	Δ <u>V1-2</u> 1% V1-3
Vibration	20g, 12 hours, 10 - 55 Hz	0.81	1%	ten	Δ <u>V1-2</u> 1% V1-3
Rotational Life (electrical and mechanical)	100 cycles at rated power	7.0	1% Operation torque Dielectric strength Insulation resistance	08.0	1.4 oz. inch 1000 V RMS > 10 ⁶ M
Load Life	1000 hours at rated power, 90"/30" ambient temperature + 85°C	35	1% Contact resistance v	variation	2% < 1% RN



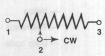




STANDARD RESISTANCE ELEMENT DATA					
		LINEAR LA	W		
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C	
10	0.50	2.2	224.0		
20	0.50	3.2	158.0	+ 200	
50	0.50	5.0	100.0	1 200	
100	0.50	7.0	70.0		
200	0.50	10.0	50.0	4 5	
500	0.50	15.8	32.0		
1k	0.50	22.4	22.0	m p gour	
2k	0.50	31.6	16.0		
5k	0.50	50.0	10.0		
10k	0.50	70.7	7.0	± 100	
20k	0.50	100.0	5.0		
50k	0.50	158.0	3.2		
100k	0.50	224.0	2.2		
200k	0.31	250.0	1.25	nulling tips	
500k	0.12	250.0	0.50		
1M	0.06	250.0	0.25		

CIRCUIT DIAGRAM

NOTE: Tolerance unless otherwise specified ± .020 [.508].



ELECTRICAL SPECIFICATIONS

Electrical Travel: 270° ± 15°.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

Temperature Coefficient: (- 55°C to + 125°C)

± 100PPM/°C for Rn ≥ 100 ohm. Power Rating: 0.5 watt at + 85°C. Limiting Element Voltage: 250 V.

Contact Resistance Variation: 3% or 3 ohm,

whichever is greater.

End Resistance Variation: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

Insulation Resistance: 106 Megohm (500 VDC).

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 15°.

Operating Torque: 3 ounce inch maximum. End Stop Torque: 5.6 ounce inch minimum.

Weight: 0.02 ounces.

Resistive Element: Cermet.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 55°C to + 125°C.

Climatic Category: 55/100/56.

Sealing: Enables cleaning. T7 trimming

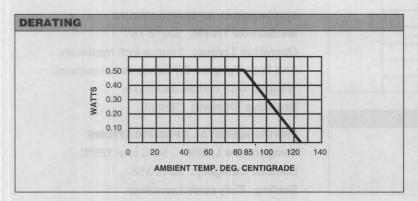
potentiometers are sealed against dust and P.C. board

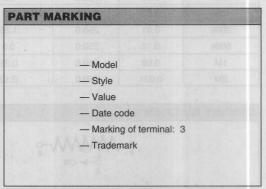
cleaning with the following solvents:

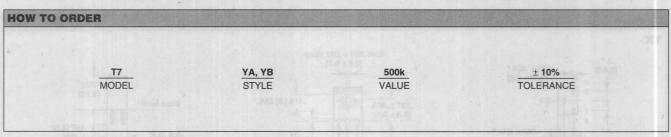
Trichlorotrifluorethane, Alcohol, Trichlorethane.

T7YA 157 [4.0] DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] 157 [4.0] DIA. 236 [6.0] 278 [7.0] DIA. 177 [4.5] MIN.

		TYPICAL VALUES AND DRIFT				
TEST'	CONDITIONS	∆RT RT %	∆R1-2 R1-2 %			
Thermal Shock	5 cycles, - 55°C to + 125°C	1%	Δ <u>V1-2</u> 2% V1-3			
Moisture Resistance (106)	10 cycles of 24 hours constituted with damp heat-cold-vibrations	2% Dielectric strength Insulation resistance	3% 1000 V RMS 10 ⁴ M			
Long Term Damp Heat	Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	2% Dielectric strength Insulation resistance	3% 1000 V RMS 10 ⁴ M			
Shock MAN DOMES IN	3 successive shocks, in 3 directions, 100g, 6 ms	1%	Δ <u>V1-2</u> 1% V1-3			
Vibration	20g, 12 hours, 10 - 55 Hz	1%	Δ <u>V1-2</u> 1% V1-3			
Rotational Life (electrical and mechanical)	200 cycles at rated power	2% Operation torque Dielectric strength Insulation resistance	1.4 oz. inch 1000 V RMS > 10 ⁶ M			
Load Life	1000 hours at rated power, 90"/30" ambient temperature + 85°C	3% Contact resistance variation	4% < 3% RN			







MODELS TX, TXD, TY (A, D, M, P) Cermet Trimmers

Miniature, Industrial Grade





FEATURES

- 0.5 watt at 85°C
- Typical contact resistance variation of 1%
- · Fully sealed
- Wide temperature range 55°C to + 125°C
- · Easy to read scale
- Excellent stability owing to multi-contact wiper in precious metal

STANDARD	RESISTANC	CE ELEMEN	T DATA	
And Royal		LINEAR LA	W	
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	
20	0.50	3.2	158.0	0 + 200
50	0.50	5.0	100.0	. 200
100	0.50	7.0	70.0	NO PULE
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	
10k	0.50	70.7	7.0	+ 100
20k	0.50	100.0	5.0	nickasalka
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.5	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

CIRCUIT DIAGRAM O-VVIII-O-3 O-V CW 1 O-V CW

APPLICATIONS

This newly designed trimming potentiometer can be mounted on PCBs as an alternative to most of the current 3/8" [9.53] square trimmers with the advantage of a significantly smaller size 9/32" [7.14].

ELECTRICAL SPECIFICATIONS

Electrical Travel: 260° ± 15°.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

±5% available.

Temperature Coefficient: ± 100PPM/°C (- 55°C to + 125°C) for Rn ≥ 100 ohm.

Power Rating: 0.5 watt at + 85°C. Limiting Element Voltage: 250 V.

Contact Resistance Variation: 1% or 2 ohm

(whichever is greater).

End Resistance Variation: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

Insulation Resistance: 106 Megohm (500 VDC).

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 15°.

Operating Torque: 3 ounce inch maximum.

End Stop Torque: 5.7 ounce inch maximum.

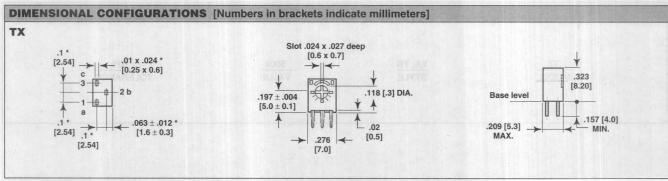
Weight: 0.02 ounces maximum.
Resistive Element: Cermet.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 55°C to + 125°C.

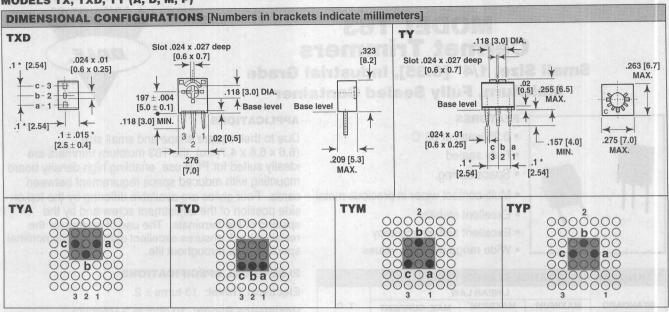
Climatic Category: 55/100/56.

Sealing: Fully sealed container.



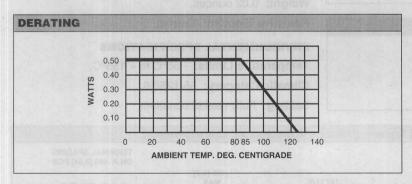
^{*} To be measured at base level

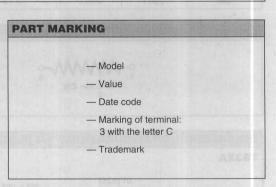
MODELS TX, TXD, TY (A, D, M, P)

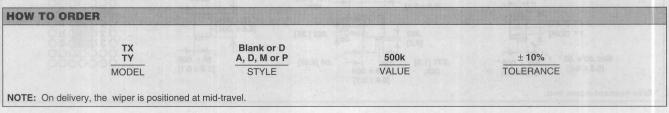


^{*} To be measured at base level.

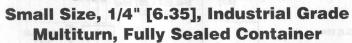
ENVIRONMENTAL PERFORMANCE				
reprinted to the second of the	0.98		DRIFTS	
CONDITIONS		ART %	∆R1-2 R1-2 %	
5 cycles, - 55°C to + 125°C	0.02	1%	Δ <u>V1-2</u> 2% V1-3	
10 cycles of 24 hours constituted with damp heat-cold-vibrations	0.86	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M	
Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	15.6	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M	
3 successive shocks, in 3 directions, 100g, 6 ms	0.0	1%	Δ <u>V1-2</u> 1% V1-3	
20g, 12 hours, 10 - 55 Hz	ag	1%	Δ <u>V1-2</u> 1% V1-3	
100 cycles at rated power	9.8 9.1 1.1	2% Operation torque Dielectric strength Insulation resistance	1.4 oz. inch 1000 V RMS > 10 ⁶ M	
1000 hours at rated power, 90"/30" ambient temperature + 85°C	0.60	1% Contact resistance variation	2% < 1% RN	
	CONDITIONS 5 cycles, - 55°C to + 125°C 10 cycles of 24 hours constituted with damp heat-cold-vibrations Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days 3 successive shocks, in 3 directions, 100g, 6 ms 20g, 12 hours, 10 - 55 Hz 100 cycles at rated power	CONDITIONS 5 cycles, - 55°C to + 125°C 10 cycles of 24 hours constituted with damp heat-cold-vibrations Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days 3 successive shocks, in 3 directions, 100g, 6 ms 20g, 12 hours, 10 - 55 Hz 100 cycles at rated power	CONDITIONS 5 cycles, - 55°C to + 125°C 10 cycles of 24 hours constituted with damp heat-cold-vibrations Temperature = 40°C, RH = 90 - 95%, Dielectric strength Insulation resistance 3 successive shocks, in 3 directions, 100g, 6 ms 20g, 12 hours, 10 - 55 Hz 100 cycles at rated power 2% Operation torque Dielectric strength Insulation resistance 1000 hours at rated power, 1%	







MODEL T63 Cermet Trimmers







FEATURES

- 0.25 watts at 85°C
- Fully sealed
- Space saving
- Multi-contact wiper in precious metal
- Excellent stability
- Excellent setting accuracy
- · Wide range of ohmic values

STANDARD	RESISTAN	CE ELEMEN	T DATA	10000
		LINEAR LA	\W	
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.25	1.58	158.0	
20	0.25	2.23	112.0	0 + 200
50	0.25	3.53	70.7	
100	0.25	5.0	50.0	
200	0.25	7.07	35.0	
500	0.25	11.2	22.0	1
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	100g, 6 d
10k	0.25	50.0	5.0	± 100
20k	0.25	70.7	3.5] ± 100
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	
200k	0.25	224.0	1.1	
500k	0.13	250.0	0.50	
1M	0.06	250.0	0.25	
OM	0.001	050.0	0.10	Thousand place

CIRCUIT DIAGRAM O 1 O C 3 O 3

APPLICATIONS

Due to their square shape and small size (6.6 x 6.8 x 4.7mm), the T63 multiturn trimmers are ideally suited for PCB use, enabling high density board mounting with reduced space requirement between cards. Four styles are available differing by the top or side position of the adjustment screw and by the spacing of the terminals. The use of cermet for the resistive track ensures excellent stability of the nominal specifications throughout life.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 13 turns ± 2.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

Temperature Coefficient: ± 100PPM/°C

(- 55°C to + 155°C) for Rn ≥ 100 ohm.

Power Rating: 0.25 watt at + 85°C. Limiting Element Voltage: 250 V.

Contact Resistance Variation: 2% Rn or 2 ohm

(whichever is greater).

End Resistance: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

Insulation Resistance: 106 Megohm (500 VDC).

MECHANICAL SPECIFICATIONS

Mechanical Travel: 15 turns ± 5.

Operating Torque: 2.1 ounce inch maximum.

End Stop Torque: Clutch action.

Weight: 0.02 ounces.

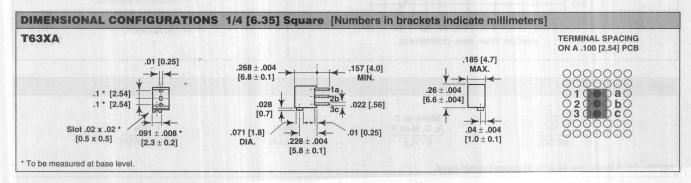
Resistive Element: Cermet.

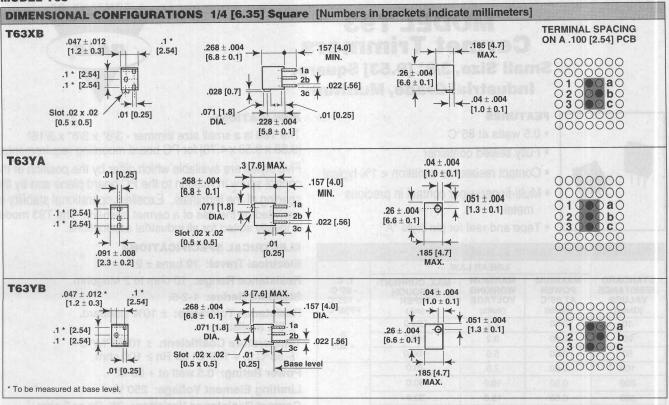
ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 55°C to + 155°C.

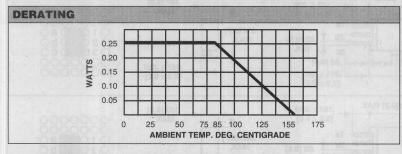
Climatic Category: 55/125/56.

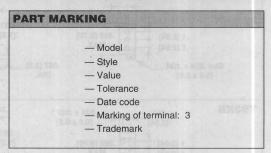
Sealing: Fully sealed container.





ENVIRONMENTAL PERF	ORMANCE			
	extinde his somethies Albert III	TYPICAL VALUES AND I		
TEST EMP	CONDITIONS	ART %	∆R1-2 R1-2 %	
Thermal Shock	5 cycles, - 55°C to + 125°C	0.5%	Δ <u>V1-2</u> 1% V1-3	
Moisture Resistance (106)	10 cycles of 24 hours constituted with damp heat-cold-vibrations	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M	
Long Term Damp Heat	Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M	
Shock	3 successive shocks, in 3 directions, 100g, 6 ms	1%	Δ <u>V1-2</u> 1% V1-3	
Vibration	20g, 12 hours, 10 - 55 Hz	1%	Δ <u>V1-2</u> 1% V1-3	
Rotational Life (electrical and mechanical)	100 cycles at rated power	1% Operation torque Dielectric strength Insulation resistance	1.4 oz. inch 1000 V RMS > 10 ⁶ M	
Load Life	1000 hours at rated power, 90"/30" ambient temperature + 85°C	1% Contact resistance variation	2% < 1% RN	



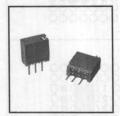


IOW TO ORDER				
T63	XA, XB, YA, YB	100k	± 10%	NOTE: On delivery, the wiper is
MODEL	STYLE	VALUE	TOLERANCE	positioned at mid-travel.

MODEL T93 Cermet Trimmers

Small Size, 3/8" [9.53] Square, Industrial Grade, Multiturn





FEATURES

- 0.5 watts at 85°C
- · Fully sealed container
- Contact resistance variation < 1% typical
- Multi-finger wiper contact in precious metal
- . Tape and reel for pin style "A"

STANDARD	RESISTAN	CE ELEMEN	T DATA	
		LINEAR LA	W	
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	+ 200
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	
10k	0.50	70.7	7.0	± 100
20k	0.50	100.0	5.0	1100
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

APPLICATIONS

The T93 is a small size trimmer - 3/8" x 3/8" x 3/16" [9.53 x 9.53 x 4.78] for PC board mounting requirements.

Five styles are available which differ by the position of the control screw in relation to the PC board plane and by the spacing of the terminals. Excellent operational stability is provided by the use of a cermet element. The T93 model is ideally suited for all industrial applications.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 19 turns ± 2.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

±5% available.

Temperature Coefficient: $\pm 100PPM/^{\circ}C$ (- 55°C to + 155°C) for Rn ≥ 100 ohm.

Power Rating: 0.5 watt at + 85°C. Limiting Element Voltage: 250 V.

Contact Resistance Variation: 2% Rn or 2 ohm

(whichever is greater).

End Resistance: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

Insulation Resistance: 106 Megohm (500 VDC).

Mechanical Travel: 22 turns + 5

Mechanical Travel: 22 turns \pm 5.

Operating Torque: 2.1 ounce inch maximum.

End Stop Torque: Clutch action.

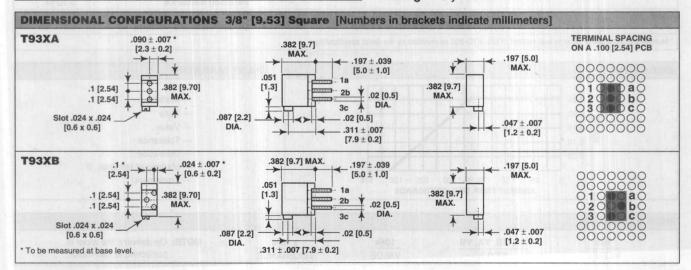
Weight: 0.04 ounces.

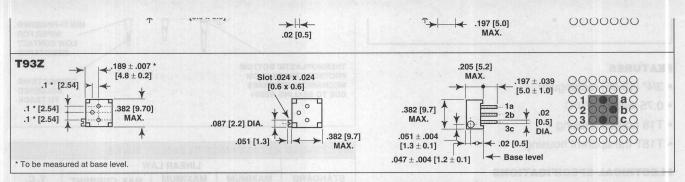
Resistive Element: Cermet.

ENVIRONMENTAL SPECIFICATIONS

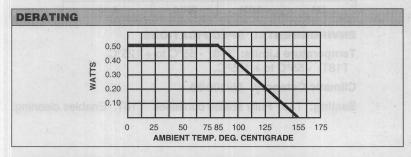
Temperature Limits: - 55°C to + 155°C.

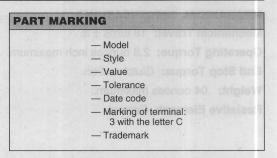
Climatic Category: 55/125/56. Sealing: Fully sealed container.





ORMANCE		
(ama's) (ama's) (ama's) (ama's)	TYPICAL VALUES AN	D DRIFTS
CONDITIONS	ΔRT %	∆R1-2 R1-2 %
5 cycles, - 55°C to + 125°C	0.5%	Δ <u>V1-2</u> 1% V1-3
10 cycles of 24 hours constituted with damp heat-cold-vibrations	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M
Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M
3 successive shocks, in 3 directions, 100g, 6 ms	1% 0.00 + 18 Haw 25 0	Δ <u>V1-2</u> 1% V1-3
20g, 12 hours, 10 - 55 Hz	1%	Δ <u>V1-2</u> 1% V1-3
100 cycles at rated power	1% Operation torque Dielectric strength Insulation resistance	1.4 oz. inch 1000 V RMS > 10 ⁶ M
1000 hours at rated power, 90"/30" ambient temperature + 85°C	1% Contact resistance variation	2% < 1% RN
	CONDITIONS 5 cycles, - 55°C to + 125°C 10 cycles of 24 hours constituted with damp heat-cold-vibrations Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days 3 successive shocks, in 3 directions, 100g, 6 ms 20g, 12 hours, 10 - 55 Hz 100 cycles at rated power	CONDITIONS 5 cycles, - 55°C to + 125°C 0.5% 10 cycles of 24 hours constituted with damp heat-cold-vibrations Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days 3 successive shocks, in 3 directions, 100g, 6 ms 1% 20g, 12 hours, 10 - 55 Hz 100 cycles at rated power 100 cycles at rated power, 100 hours at rated power, 100 176 ART % 100 cycles at rated power 100 hours at rated power, 100 187 ART % 100 198 ART % 100 pielectric strength linsulation resistance



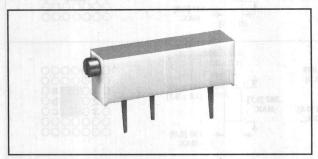


HOW T	O ORDER	activistic materials best to			
A	T93	XA, XB, YA, YB, Z	100k	± 10%	NOTE: On delivery, the wiper is
L. V. X.	MODEL	STYLE	VALUE	TOLERANCE	positioned at mid-travel.

MODELS T18 and T18T Cermet Trimmers







FEATURES

- 3/4" [19.05] rectangular
- 0.75 watts at 70°C
- T18 normal housing
- T18T transparent housing

ELECTRICAL SPECIFICATIONS

Electrical Travel: 15 turns ± 1.

Resistance Range: 10 ohm to 2 Megohm.

Standard Series: 1-2-5.

Resistance Tolerance: ± 10% standard.

Temperature Coefficient:

T18: $(-55^{\circ}\text{C to} + 125^{\circ}\text{C}) \pm 100\text{PPM/}^{\circ}\text{C}$

for $Rn \ge 100$ ohm.

T18T: (- 55°C to + 105°C) ± 100PPM/°C

for $Rn \ge 100$ ohm.

Power Rating: 0.75 watt at + 70°C. Limiting Element Voltage: 250 volts.

Contact Resistance Variation: 2% or 2 ohm,

whichever is greater.

End Resistance Variation: 1 ohm typical.

Dielectric Strength: 1000 V RMS.

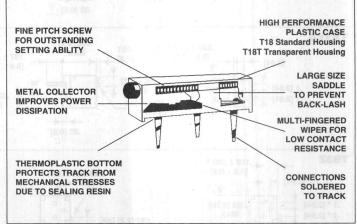
Insulation Resistance: 106 Megohm, 500 VDC.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 18 turns ± 3.

Operating Torque: 2.8 ounces inch maximum.

End Stop Torque: Clutch action.
Weight: .04 ounces maximum.
Resistive Element: Cermet.



		LINEAR LA	W West Chandles Street	dom ad oT
STANDARD RESISTANCE VALUES (Ohms)	MAXIMUM POWER AT 70°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.75	2.7	270.0	
20	0.75	3.9	195.0	+ 200
50	0.75	6.1	122.0	
100	0.75	8.7	87.0	Lywinia
200	0.75	12.2	61.0	
500	0.75	19.4	39.0	meT gno
1k	0.75	27.4	27.0	100
2k	0.75	38.7	19.0	1 stoom
5k	0.75	61.2	12.0	
10k	0.75	86.6	9.0	± 100
20k	0.75	122.0	6.0	100
50k	0.75	194.0	4.0	s learmails
100k	0.625	250.0	2.5	
200k	0.31	250.0	1.25	etili beo
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	Nutroberts in
2M	0.031	250.0	0.12	

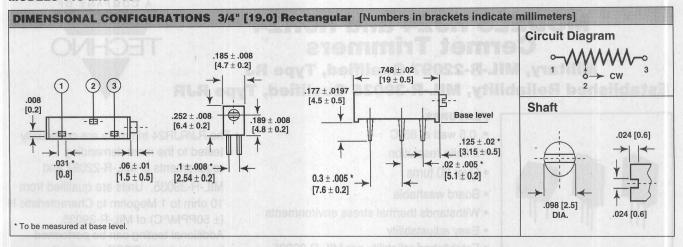
ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: T18: -55°C to + 125°C.

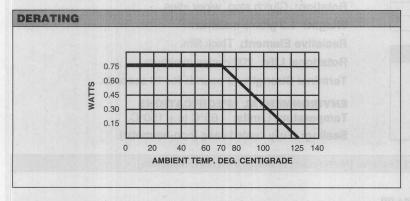
T18T: - 55°C to + 105°C.

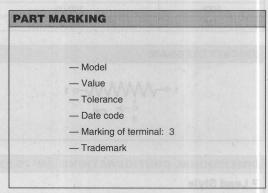
Climatic Category: 55/100/56.

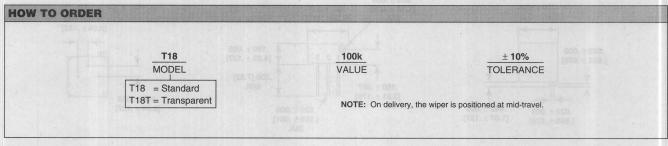
Sealing: T18: Fully sealed container. T18T: Enables cleaning.



ENVIRONMENTAL PERF	JAMANGE		
		TYPICAL VALUES AN	D DRIFTS
TEST '	CONDITIONS	∆RT RT %	∆R1-2 R1-2 %
Thermal Shock	5 cycles, - 55°C to + 125°C	0.5%	Δ <u>V1-2</u> 1% V1-3
Moisture Resistance (106)	10 cycles of 24 hours constituted with damp heat-cold-vibrations	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M
Long Term Damp Heat	Temperature = 40°C, RH = 90 - 95%, 10% rated power/56 days	1% Dielectric strength Insulation resistance	2% 1000 V RMS 10 ⁴ M
Shock	3 successive shocks, in 3 directions, 100g, 6 ms	1%	Δ <u>V1-2</u> 1% V1-3
Vibration	20g, 12 hours, 10 - 55 Hz	1%	Δ <u>V1-2</u> 1% V1-3
Rotational Life (electrical and mechanical)	100 cycles at rated power	1% Operation torque Dielectric strength Insulation resistance	1.4 oz. inch 1000 V RMS >10 ⁶ M
Load Life	1000 hours at rated power, 90"/30" ambient temperature + 85°C	1% Contact resistance variation	2% < 1% RN



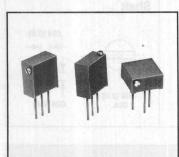




MODELS RJ24 and RJR24 Cermet Trimmers





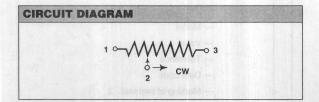


FEATURES

- 0.5 watt at 85°C
- Infinite resolution
- Over 20 turns
- · Board washable
- · Withstands thermal stress environments
- · Easy adjustability
- Established reliability per MIL-R-39035
- Solderable leads, Hot Solder Dipped

The RJ/RJR24 trimmers are continually tested to the most demanding requirements of MIL-R-22097 and MIL-R-39035. Units are qualified from 10 ohm to 1 Megohm to Characteristic H (± 50PPM/°C) of MIL-R-39035. Additional testing can be performed by our in-houseDESC-approved testing facilities.

STANDARD RESI	STANDARD RESISTANCE VALUES		
3/8" [9.52] MODELS RJ24 and RJR24		
RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE (Volts)		
2WF V 0.10	2.23		
20	3.10		
50	5.00		
100	7.00		
200	10.00		
500	15.80		
1k	22.30		
2k	31.60		
5k	50.00		
10k	70.70		
20k	100.00		
25k	111.00		
50k	158.00		
100k	223.00		
250k	300.00		
500k	300.00		



300.00

1M

ELECTRICAL SPECIFICATIONS

Electrical Travel: 25 ± 2 turns.

Resistance Range: 10 ohm to 1 Megohm. Resistance Tolerance: \pm 10% standard.

Temperature Coefficient: (- 55°C to + 150°C) ± 100PPM/°C.

± 50PPM/°C available.

Power Rating: 0.5 watt at 85°C derated to 0 watt at 150°C. **Maximum Contact Resistance Variation (CRV):** 3% of R or 3 ohm, whichever is greater, typical 0.5%.

End Resistance: 2% of R or 2 ohm, whichever is greater,

typical 0.2 ohm.

Dielectric Strength: 1000 VAC at ambient temperature. **Insulation Resistance:** > 100,000 Megohm (500 VDC).

MECHANICAL SPECIFICATIONS

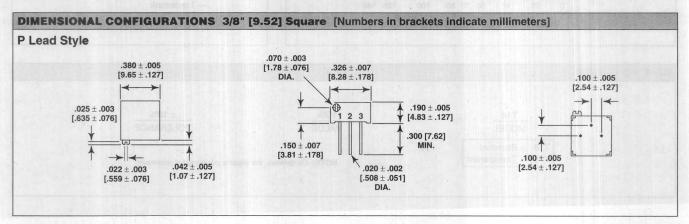
Operating Torque: 5 ounce inch maximum.

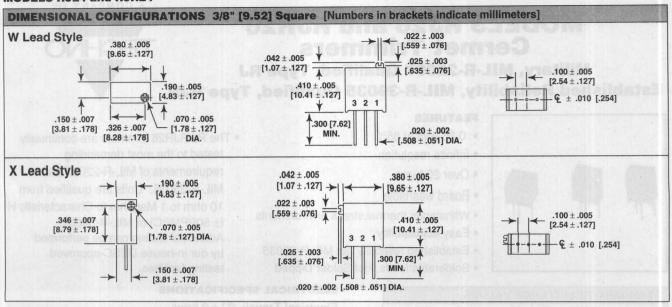
Rotation: Clutch stop, wiper idles.
Weight: 1.3 grams maximum.
Resistive Element: Thick film.

Rotational Life: 200 cycles minimum.

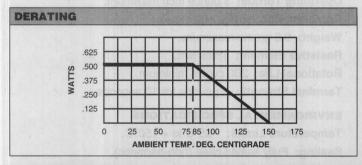
Terminal Strength: 2 pounds for 10 seconds.

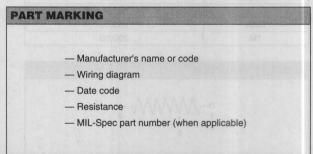
ENVIRONMENTAL SPECIFICATIONS Temperature Limits: - 65°C to + 150°C. **Sealing:** Fully sealed case (non-hermetic).

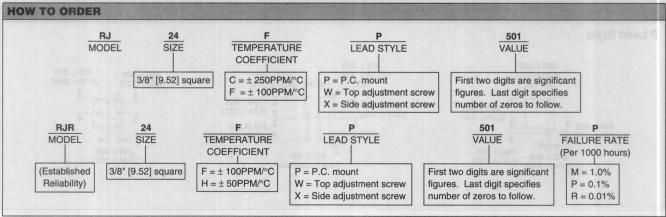




ENVIRONMENTAL PER	PERFORMANCE			
TEST ¹	stand	CONDITIONS	MIL-R-39035 REQUIREMENT	TYPICAL CHANGE
Power Conditioning	(108)	50 hours at 0.75 watt at 25°C, 90"/30" cycle	ΔR ≤ 1.0%	ΔR < 0.26%
Thermal Shock	(107)	5 cycles, - 65°C to + 150°C	ΔR ≤ 1.0%	ΔR < 0.09%
Low Temperature Storage	ab Ore	24 hours, no load at - 65°C	ΔR ≤ 1.0%	ΔR < 0.12%
Low Temperature Operation	Sand to	1 hour storage, 45 minutes rated power at - 55°C	ΔR ≤ 1.0%	ΔR < 0.03%
High Temperature Exposure	sinut n	1000 hours, no load at 150°C	ΔR ≤ 3.0%	ΔR < 0.85%
Moisture Resistance	(106)	480 hours at rated power with humidity ranging from 80% RH to 98% RH	ΔR ≤ 1.0%	ΔR < 0.21%
Resistance to Soldering Heat	(210)	350°C for 3 seconds	ΔR ≤ 1.0%	ΔR < 0.02%
Shock	(213)	18 shocks, 100g, 6 ms, sawtooth, 3 axes	ΔR ≤ 1.0%	ΔR < 0.02%
Vibration	(204)	10 to 2000 Hz, 20g, 12 hours, 3 axes	ΔR ≤ 1.0%	ΔR < 0.10%
Rotational Life	VI 000 I	200 cycles	ΔR ≤ 2.0%	ΔR < 0.27%
Load Life	(108)	10,000 hours at rated power at 85°C, 90"/30" cycle	ΔR ≤ 3.0%	ΔR < 0.96%
1. Numbers in parenthesis refer to t	est metho	d of MIL-STD-202 as modified by the detail specification.	ISSECTION OF THE PARTY.	- 108



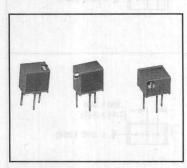




MODELS RJ26 and RJR26 Cermet Trimmers



Military, MIL-R-22097 Qualified, Type RJ Established Reliability, MIL-R-39035 Qualified, Type RJR



500k

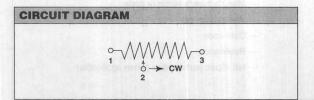
1M

FEATURES

- 0.25 watt at 85°C
- · Infinite resolution
- Over 20 turns
- Board washable
- · Withstands thermal stress environments
- Easy adjustability
- Established reliability per MIL-R-39035
- · Solderable leads, Hot Solder Dipped

The RJ/RJR26 trimmers are continually tested to the most demanding requirements of MIL-R-22097 and MIL-R-39035. Units are qualified from 10 ohm to 1 Megohm to Characteristic H (± 50PPM/°C) of MIL-R-39035. Additional testing can be performed by our in-house DESC-approved testing facilities.

1/4" [6.35] MODELS RJ26 and RJR26		
RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE (Volts)	
10	1.58	
20	2.23	
50	3.54	
100	5.00	
200	7.07	
500	R0.8≥RA 11.10	
1k	15.80	
2k	22.30	
5k	35.40	
10k	50.00	
20k	70.07	
25k	79.00	
50k	111.00	
100k	158.00	
250k	200.00	



200.00

200.00

ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 2 turns.

Resistance Range: 10 ohm to 1 Megohm. Resistance Tolerance: \pm 10% standard.

Temperature Coefficient: (- 55°C to + 150°C) ± 100PPM/°C.

± 50PPM/°C available.

Power Rating: 0.25 watt at 85°C derated to 0 watt at 150°C. Maximum Contact Resistance Variation (CRV): 3% of R or 3 ohm, whichever is greater, typical 0.5%.

End Resistance: 2% of R or 2 ohm, whichever is greater,

typical 0.2 ohm.

Dielectric Strength: 1000 VAC at ambient temperature. **Insulation Resistance:** > 100,000 Megohm (500 VDC).

MECHANICAL SPECIFICATIONS

Operating Torque: 3 ounce inch maximum.

Rotation: Clutch stop, wiper idles.
Weight: 0.6 grams maximum.
Resistive Element: Thick film.

Rotational Life: 200 cycles minimum.

Terminal Strength: 2 pounds for 10 seconds.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 150°C. **Sealing:** Fully sealed case (non-hermetic).

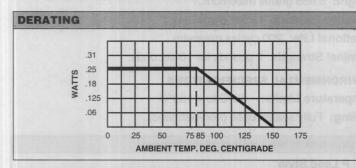
DIMENSIONAL CONFIGURATIONS 1/4" [6.35] Square [Numbers in brackets indicate millimeters] P Lead Style .265 ± .005 .070 ± .005 .125 + .010 $[6.73 \pm .127]$ $[1.78 \pm .127]$.217 ± .007 .100 ± .005 [3.18 ± .254] [2.54 ± .127] DIA. [5.51 ± .178] $\textbf{.190} \pm \textbf{.005}$.265 ± .005 $.146 \pm .007$ [4.83 ± .127] $[6.73 \pm .127]$ [3.71 ± .178] .025 ± .003 .172 [4.37] [.635 ± .076] .042 + .005.100 ± .005 $.022 \pm .003$.016 ± .001 [1.07 ± .127] [2.54 ± .127] [.559 ± .076] [.406 ± .025] DIA

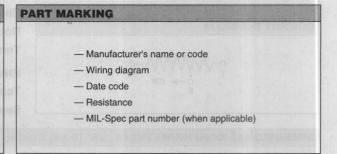


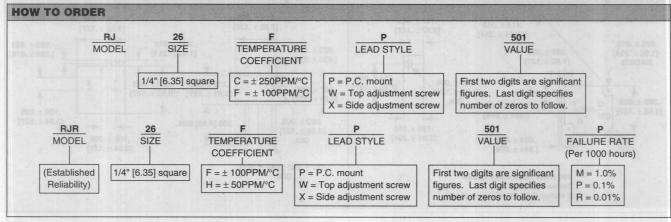




ENVIRONMENTAL PERFORMANCE					
TEST' D'OET IS NEW D O	t betsi	CONDITIONS	MIL-R-39035 REQUIREMENT	TYPICAL CHANGE	
Power Conditioning	(108)	50 hours at 0.375 watt at 25°C, 90"/30" cycle	ΔR ≤ 1.0%	ΔR < 0.15%	
Thermal Shock	(107)	5 cycles, - 65°C to + 150°C	ΔR ≤ 1.0%	ΔR < 0.09%	
Low Temperature Storage		24 hours, no load at - 65°C	ΔR ≤ 1.0%	ΔR < 0.10%	
Low Temperature Operation		1 hour storage, 45 minutes rated power at - 55°C	ΔR ≤ 1.0%	ΔR < 0.02%	
High Temperature Exposure	refield.	1000 hours, no load at 150°C	ΔR ≤ 3.0%	ΔR < 0.80%	
Moisture Resistance	(106)	480 hours at rated power with humidity ranging from 80% RH to 98% RH	ΔR ≤ 1.0%	ΔR < 0.08%	
Resistance to Soldering Heat	(210)	350°C for 3 seconds	ΔR ≤ 1.0%	ΔR < 0.02%	
Shock	(213)	18 shocks, 100g, 6 ms, sawtooth, 3 axes	ΔR ≤ 1.0%	ΔR < 0.03%	
Vibration	(204)	10 to 2000 Hz, 20g, 12 hours, 3 axes	ΔR ≤ 1.0%	ΔR < 0.06%	
Rotational Life	ministr	200 cycles	ΔR ≤ 2.0%	ΔR < 0.20%	
Load Life	(108)	10,000 hours at rated power at 85°C, 90"/30" cycle	ΔR ≤ 3.0%	ΔR < 0.50%	
1. Numbers in parenthesis refer to te	est method	of MIL-STD-202 as modified by the detail specification.	famine nomi eldelant el	Ottober inselations	



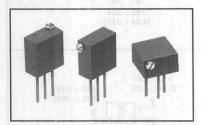




MODELS RT24 and RTR24 Wirewound Trimmers



Military, MIL-R-27208 Qualified, Type RT Established Reliability, MIL-R-39015 Qualified, Type RTR



FEATURES

- Precious metal wiper
- 1.0 watt to 85°C
- TCR ± 50PPM/°C
- Solderable leads
- · Military quality at affordable prices
- Established Reliability to 0.01%/1,000 hours R level per MIL-R-39015 (Type RTR)

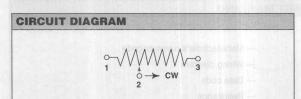
APPLICATIONS

Wirewound trimmers are particularly useful in those applications where any combination of high power, low temperature coefficient of resistance and/or excellent long term life stability are important design considerations.

STANDARD RESISTANCE VALUES

3/8" [9.52] M	ODELS RT24 and RTR24			
RESISTANCE* (Ohms)	NOMINAL RESOLUTIO			
10	1.10			
20	.85			
50	.65			
100	.51			
200	.40			
500	.45			
1k	.34			
2k	.27			
5k	.20			
10k	.16			
20k	.13			
25k	.12			
35k	11. AR≤2.0			
50k	.10			

* Other resistances available upon request. Bold type indicates MIL approved range.



ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns.

Resistance Range1: 10 ohm to 10 kilohm.

Resistance Tolerance: ±5% standard. Closer tolerances available.

Temperature Coefficient: $(-65^{\circ}\text{C to} + 150^{\circ}\text{C}) \pm 50\text{PPM/°C}$. Power Rating²: 1.0 watt at 85°C derated to 0 watt at 150°C.

End Resistance: 1 ohm or 2%, whichever is greater.

Equivalent Noise Resistance (ENR): 100 ohm maximum.

Dielectric (DWV)²: 1000 VAC at atmospheric pressure. Insulation Resistance²: > 100,000 Megohm (500 VDC).

NOTES: 1. Extended range available in non MIL Spec product.

2. These specifications exceed MIL Spec.

MECHANICAL SPECIFICATIONS

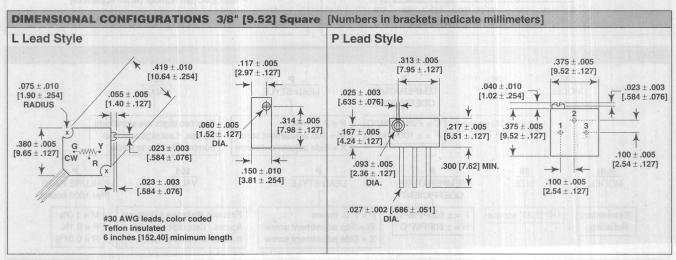
Operating Torque: 5 ounce inch maximum.

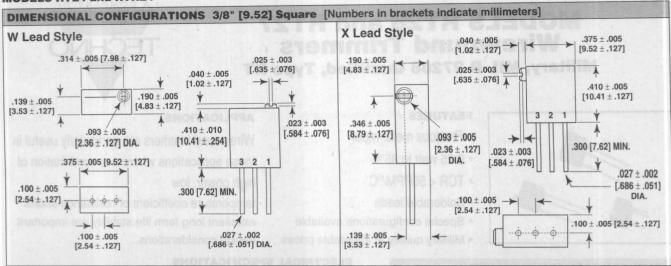
Rotation: Clutch stop, wiper idles.
Weight: 0.935 grams maximum.
Resistive Element: Nickel chromium.
Rotational Life: 200 cycles minimum.

Terminal Strength: 2 pounds for 10 seconds.

ENVIRONMENTAL SPECIFICATIONS

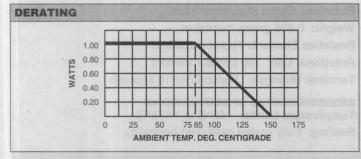
Temperature Limits: - 65°C to + 150°C. **Sealing:** Fully sealed case (non-hermetic).



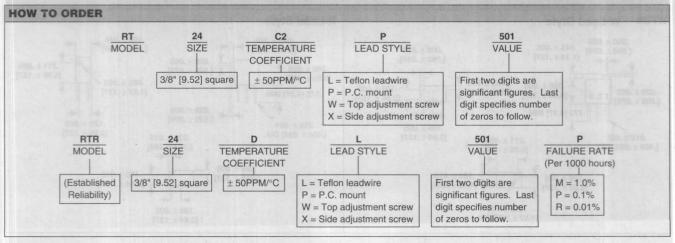


ENVIRONMENTAL PERFORMANCE					
TEST ¹	Institutions Institutions	CONDITIONS	MIL-R-39015 REQUIREMENT	TYPICAL CHANGE	
Power Conditioning	(108)	50 hours at 1 watt at 25°C, 90"/30" cycle	$\Delta R \le 0.5\%^2$	ΔR < 0.08%	
Thermal Shock	(107)	5 cycles, - 55°C to + 125°C	$\Delta R \le 1.0\%^2$	ΔR < 0.07%	
Low Temperature Storage	Salarania V	72 hours, no load at - 65°C	$\Delta R \le 1.0\%^2$	ΔR < 0.05%	
Low Temperature Operatio	n	1 hour storage, 45 minutes rated power at - 55°C	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.08%	
High Temperature Exposur	е	1000 hours, no load at 150°C	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.03%	
Moisture Resistance	(106)	480 hours at rated power with humidity ranging from 80% RH to 98% RH	$\Delta R \le 1.0\%^2$	ΔR < 0.22%	
Resistance to Soldering He	at (210)	350°C for 3 seconds	$\Delta R \le 1.0\%^2$	ΔR < 0.02%	
Shock	(213)	18 shocks, 100g, 6 ms, sawtooth, 3 axes	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.27%	
Vibration	(204)	10 to 2000 Hz, 20g, 12 hours, 3 axes	$\Delta R \leq 1.0\%^{2,3}$	$\Delta R < 0.04\%$	
Rotational Life	I I II OIGISI	200 cycles	ΔR ≤ 2.0%	ΔR < 0.06%	
Load Life	(108)	10,000 hours at rated power at 85°C, 90"/30" cycle	ΔR ≤ 3.0%	ΔR < 0.23%	

- Numbers in parenthesis refer to test method of MIL-STD-202 as modified by the detail specification.
 For values below 100 ohm, add 0.05 ohm to the allowable change.
 The referenced tests also require that setting stability change shall not exceed ± 0.05 percent plus the specified maximum resolution.



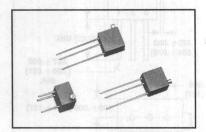
PART MARKING - Manufacturer's name or code — Wiring diagram Date code - Resistance MIL-Spec part number (when applicable)



MODELS RT26 and RT27 Wirewound Trimmers

Military, MIL-R-27208 Qualified, Type RT





FEATURES

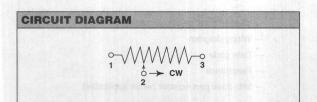
- · Precious metal wiper
- 0.25 watt to 85°C
- TCR < 50PPM/°C
- Solderable leads
- · Special configurations available
- · Military quality at affordable prices

APPLICATIONS

Wirewound trimmers are particularly useful in those applications where any combination of high power, low

temperature coefficient of resistance and/or excellent long term life stability are important design considerations.

1/4" [6.35] M	ODELS RT26 and RT27
RESISTANCE* (Ohms)	NOMINAL RESOLUTION (%)
10	1.65
20	1.35
50	1.13
100	.82
200	.62
500	.62
190 - 81k	.49
2k	.34
5k	.27
10k	.21
20k	.17
25k	.16



ELECTRICAL SPECIFICATIONS

Electrical Travel: 22 ± 4 turns.

Resistance Range¹: 10 ohm to 5 kilohm. Resistance Tolerance: \pm 5% standard.

Closer tolerances available.

Temperature Coefficient: (- 65°C to + 150°C) ± 50PPM/°C. Power Rating²: 0.5 watt at 85°C derated to 0 watt at 150°C. End Resistance: 1 ohm or 2%, whichever is greater. Equivalent Noise Resistance (ENR): 100 ohm maximum. Dielectric (DWV)²: 1000 VAC at atmospheric pressure.

Insulation Resistance²: > 100,000 Megohm (500 VDC).
 NOTES: 1. Extended range available in non MIL Spec product.
 2. These specifications exceed MIL Spec.

MECHANICAL SPECIFICATIONS

Operating Torque: 3 ounce inch maximum, RT26.

5 ounces inch maximum, RT27.

Rotation: Clutch stop, wiper idles.

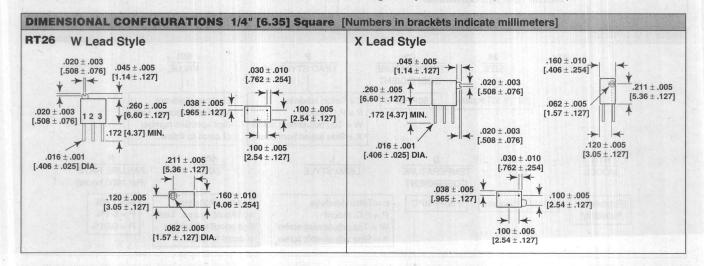
Weight: 0.935 grams maximum.

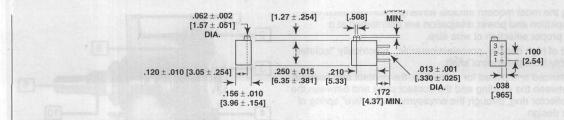
Resistive Element: Nickel chromium.

Rotational Life: 200 cycles minimum.

Terminal Strength: 2 pounds for 10 seconds.

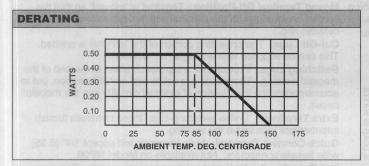
ENVIRONMENTAL SPECIFICATIONS Temperature Limits: - 65°C to + 175°C. **Sealing:** Fully sealed case (non-hermetic).

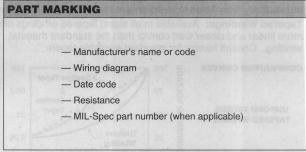


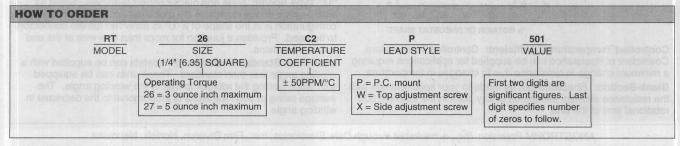


ENVIRONMENTAL PERFORMANCE					
TEST'		CONDITIONS 1990 1980 1990 1990 1990 1990 1990 1990	MIL-R-27208 REQUIREMENT	TYPICAL CHANGE	
Thermal Shock	(107)	5 cycles, - 55°C to + 125°C	$\Delta R \le 1.0\%^2$	ΔR < 0.02%	
Low Temperature Operation	abiuris R	1 hour storage, 45 minutes rated power at - 55°C	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.01%	
High Temperature Exposure	1011 L	250 hours, no load at 150°C	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.03%	
Moisture Resistance	(106)	240 hours at rated power with humidity ranging from 80% RH to 98% RH	$\Delta R \le 1.0\%^2$	ΔR < 0.02%	
Resistance to Soldering Heat	(210)	350°C for 3 seconds	$\Delta R \le 1.0\%^2$	ΔR < 0.01%	
Shock	(213)	18 shocks, 100g, 6 ms, sawtooth, 3 axes	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.07%	
Vibration	(204)	10 to 2000 Hz, 20g, 12 hours, 3 axes	$\Delta R \le 1.0\%^{2,3}$	ΔR < 0.02%	
Rotational Life	The state of the s	200 cycles	$\Delta R \le 2.0\%$	ΔR < 0.04%	
Load Life	(108)	1,000 hours at rated power at 85°C, 90"/30" cycle	ΔR ≤ 2.0%	ΔR < 0.12%	

- 1. Numbers in parenthesis refer to test method of MIL-STD-202 as modified by the detail specification.
- 2. For values below 100 ohm, add 0.05 ohm to the allowable change.
- 3. The referenced tests also require that setting stability change shall not exceed ± 1.0 percent plus the specified maximum resolution and operating torque shall not exceed 150% of the specified maximum.







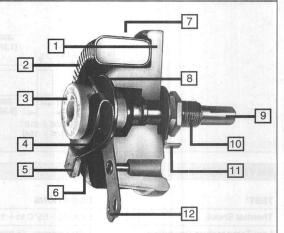
Power Rheostats Standard and Special Features



Angstrohm's broad line of vitreous enameled power rheostats is designed to provide exceptional reliability through the application of modern manufacturing techniques and the use of sophisticated materials. These same techniques have resulted in a line of power rheostats that feature a very compact size for their dissipation rating. Furthermore, many standard value rheostats are available for "off-the-shelf" delivery, while special devices are available with short delivery cycles.

STANDARD DESIGN FEATURES

- Base and Ring: Molded of high density ceramic, the base and ring provide the rheostat foundation.
- Winding: Utilizing the most modern toroidal winding machines assures a uniform wind. Resolution and power dissipation are maintained at a maximum through proper selection of wire size.
- Insulator: Molded of high density, porcelain/ceramic. Electrically "isolates" the contact assembly from the control shaft.
- 4. Contact Arm: Balanced and plated for protection, the contact arm assures positive contact between the winding and the contact shoe and between the contact ring and collector ring, through the employment of a "live" spring of simple, yet reliable design.
- Contact Shoe: Fabricated of long-life, metallic material. Minimizes wire wear and assures excellent current conduction from the winding to the center terminal.
- 6. Shunt Pigtail: Carries the current from the contact shoe to the contact ring.
- 7. Vitreous Enamel: Provides the "bonding medium" necessary to securely attach the ring and base together and to lock the windings from shifting.
- Contact Ring: Provides high current carrying capabilities through its large surface area to the center terminal. The ring is nickel plated to withstand corrosion.
- Control Shaft: Manufactured to exacting tolerances and protected from adverse environments by plating, the shaft provides for rotation of the contact assembly.
- Bushing: Precision machined, the polished brass bushing affords smooth, uniform rotation of the control shaft.



- 11. Locating Tab: Provides rheostat indexing and "non-turn" feature. The tab may be ordered at 3, 6, 9 or 12 o'clock positions. 6 o'clock is standard on all models - rheostat terminals located downward.
- 12. Three Terminals: Permit use as a potentiometer or rheostat. The center terminal or "collector ring," collects the current from the winding via the shoe-shunt assembly.

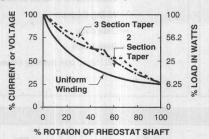
SPECIAL DESIGN FEATURES

Our application engineering department will be glad to advise you on special features (some of which are listed here). Send your requirements to the factory for analysis and we will design a unit to meet your needs. Please furnish your data in as complete a fashion as possible. This helps to avoid delays in completion of projects.

Tapered Windings: Available in all sizes, tapered windings offer more linear and closer load control than the standard rheostat winding. Consult factory for standard available tapers.

COMPARISON CURVES

UNIFORM VERSUS TAPERED WINDING



Controlled Temperature Coefficient: Controlled Temperature Coefficient of Resistance can be supplied for applications requiring a minimum change in resistance due to changes in temperature.

Blank-Section: Rheostats can be made to your specifications with the resistance element eliminated at any point in the inherent 300° rotational limit of the unit.

Dead-Lug Off-Position: The rheostat resistive circuit is opened at the "high resistance" end position. This should be restricted to units of medium resistance values in low current applications.

Moved Terminal Off-Position: Terminal is "moved" so that the contact brush slides off the terminal onto a dead-section of the ceramic ring.

Cut-Off Lugs: The projecting portion of the terminal is omitted. This can be supplied with any style "off" position.

Switching Lugs: Provides for a tap switch effect at the end of the rheostat winding. These lugs are not to add an "off" position, but to accommodate the introduction of external circuitry into the rheostat circuit.

Extra Terminals: Unlike switching-lugs, these terminals furnish intermediate taps within the winding.

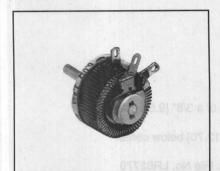
Quick-Connect Terminal: Male terminals will accept 1/4" [6.35] wide female connectors. Not available on Model MP06.

"U" Type Spade: Male and quick-connect terminals. Same as single-space above except on the rheostats and terminals, the configuration is in the shape of a "U" to allow two female connectors to be used. Provides a junction for more than one wire at the end terminal locations.

Less Than Standard Rotation: Rheostats can be supplied with a winding angle less than standard. These units can be equipped with stops limiting the rotation to that of the winding angle. The wattage rating of such rheostats is proportional to the decrease in winding angle.

MODEL MP06 Power Rheostats 12.5 Watt





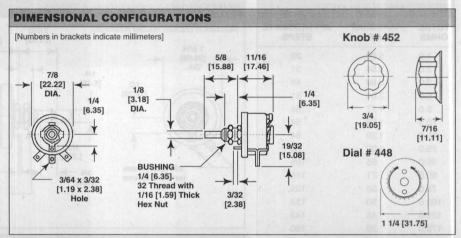
RESIST	ANCE VAL	JES*
TOTAL	MAXIMUM AMPS	APPROXIMATE STEPS
1.0	3.530	29
2.0	2.500	42
2.5	2.240	38
3.0	2.040	44
5.0	1.580	40
6.0	1.440	48
8.0	1.250	51
10.0	1.120	51
15.0	.910	51
25.0	.710	73
35.0	.600	75
50.0	.500	86
75.0	.410	103
100.0	.350	108
125.0	.320	128
150.0	.290	128
175.0	.270	148
200.0	.250	130
250.0	.220	166
350.0	.190	185
500.0	.160	215
750.0	.130	255
1000.0	.110	260
1500.0	.091	310
2500.0	.071	321
3500.0	.060	378
5000.0	.050	430

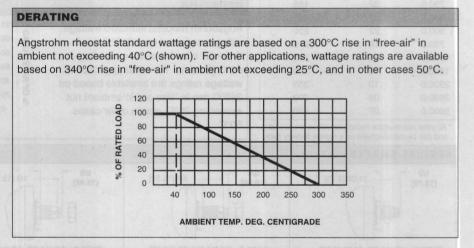
^{*} All other intermediate resistance values are available and can be manufactured on a normal delivery cycle.

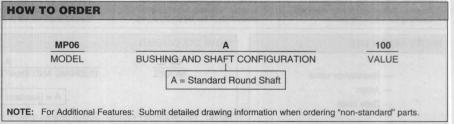
PART MARKING — Resistance value — Amps — Date code

FEATURES

- Diameter 7/8" [22.22]
- Depth behind panel 11/16" [17.46]
- Shaft 1/8" [3.18] diameter
- Rotation 300° ± 5°
- Weight .037 pounds (17 grams)
- Mounts on panels up to 1/8" [3.18] by means of a 1/4" [6.35], 32 bushing and hex nut
- Non-turn lugs require 1/8" [3.18] hole, 1/4" [6.35] below center of shaft Type "A" shaft







MODEL MP10 Power Rheostats 25 Watt

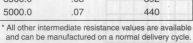


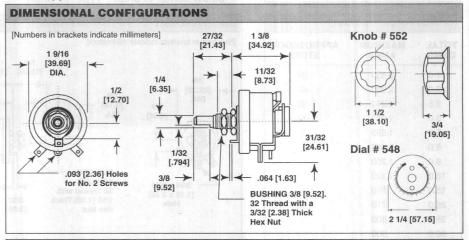


FEATURES

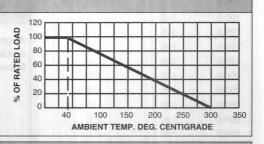
- Diameter 1 9/16" [39.69]
- Depth behind panel 1 3/8" [34.92]
- Shaft 1/4" [6.35] diameter
- Rotation 300° ± 5°
- Weight .180 pounds (82 grams)
- Mounts on panels up to 1/4" [6.35] by means of a 3/8" [9.52], 32 bushing and hex nut
- Non-turn lugs require 3/16" [4.76] hole, 1/2" [12.70] below center of shaft - Type "A" shaft
- U. L. Approved, File No. E51076 and C. S. A. File No. LR62770

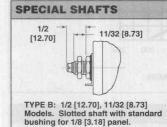
RESIST	ANCE VAL	JES*
TOTAL OHMS	MAXIMUM AMPS	APPROXIMATE STEPS
1.0	5.00	28
2.0	3.54	31
3.0	2.89	48
6.0	2.04	51
8.0	1.77	54
10.0	1.58	54
15.0	1.29	64
25.0	1.00	86
35.0	.85	105
50.0	.71	115
75.0	.58	135
100.0	.50	152
125.0	.45	143
175.0	.38	160
250.0	.32	185
350.0	.27	205
500.0	.22	230
750.0	.18	270
1000.0	.16	292
1500.0	.13	353
2500.0	.10	358
3500.0	.08	392
5000.0	.07	440

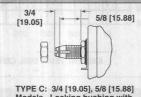




Angstrohm rheostat standard wattage ratings are based on a 300°C rise in "free-air" in ambient not exceeding 40°C (shown). For other applications, wattage ratings are available based on 340°C rise in "free-air" in ambient not exceeding 25°C, and in other cases

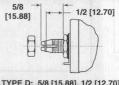


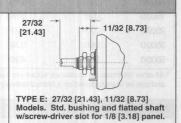




50°C

DERATING





Models. Locking bushing with slotted shaft for 1/4 [6.35] panel

MP10

MODEL

TYPE D: 5/8 [15.88], 1/2 [12.70] Models. Locking bushing with slotted shaft for 1/8 [3.18] panel.

NOTE: For Additional Features: Submit detailed drawing information when ordering "non-standard" parts.

PART MARKING HOW TO ORDER

- Resistance value
- Amps— Date code
- (a) Ed C (yab)

BUSHING AND SHAFT CONFIGURATION

VALUE

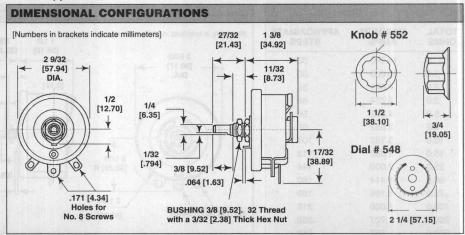
A = Standard Flatted Shaft



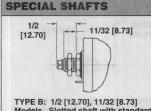
RESISTANCE VALUES* MAXIMUM **APPROXIMATE** TOTAL OHMS STEPS AMPS .5 10.00 24 1.0 7.07 46 2.0 5.00 50 4.0 3.54 44 6.0 2.89 74 2.50 85 8.0 12.0 2.04 108 16.0 1.76 108 22.0 1.50 123 35.0 1.19 148 1.00 50.0 113 80.0 .79 147 125.0 .63 178 150.0 .58 173 203 225.0 .47 214 300.0 .41 .32 290 500.0 800.0 .25 365 1000.0 .22 358 1600.0 .18 367 460 2500.0 .14 3500.0 .12 505 5000.0 .10 565 .08 695 8000.0 100000.0 .07 693

* All other intermediate resistance values are available and can be manufactured on a normal delivery cycle. DUSTING AND NEX HUL

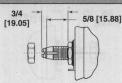
- Non-turn lugs require 3/16" [4.76] hole, 1/2" [12.70] below center of shaft - Type "A" shaft
- U. L. Approved, File No. E51076 and C. S. A. File No. LR62770



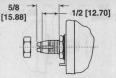
DERATING 120 Angstrohm rheostat standard wattage OF RATED LOAD 100 ratings are based on a 300°C rise in 80 "free-air" in ambient not exceeding 60 40°C (shown). For other applications, 40 wattage ratings are available based on 20 340°C rise in "free-air" in ambient not exceeding 25°C, and in other cases 40 100 150 200 250 300 350 50°C. AMBIENT TEMP, DEG, CENTIGRADE



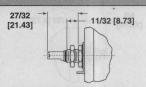
Models. Slotted shaft with standard bushing for 1/8 [3.18] panel.



TYPE C: 3/4 [19.05], 5/8 [15.88] Models. Locking bushing with slotted shaft for 1/4 [6.35] panel.



TYPE D: 5/8 [15.88], 1/2 [12.70] Models. Locking bushing with slotted shaft for 1/8 [3.18] panel.



TYPE E: 27/32 [21.43], 11/32 [8.73] Models. Std. bushing and flatted shaft w/screw-driver slot for 1/8 [3.18] panel.

PART MARKING

- Resistance value
- Date code
- Amps

HOW TO ORDER

MP15 MODEL **BUSHING AND SHAFT CONFIGURATION**

5 VALUE

A = Standard Flatted Shaft

NOTE: For Additional Features: Submit detailed drawing information when ordering "non-standard" parts.

MODEL MP25 Power Rheostats



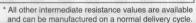


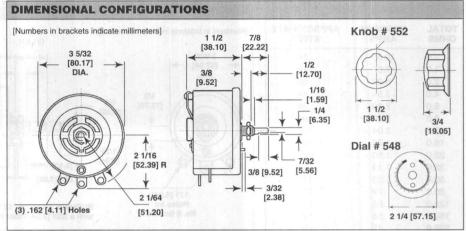


FEATURES

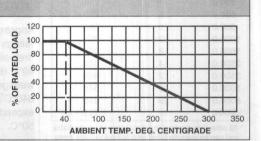
- Diameter 3 5/32" [80.17]
- Depth behind panel 1 1/2" [38.10]
- Shaft 1/4" [6.35] diameter
- Rotation 300° ± 5°
- Weight .594 pounds (268 grams)
- Mounts on panels up to 1/4" [6.35] by means of a 3/8" [9.52], 32 bushing and hex nut
- Non-turn lugs require 3/16" [4.76] hole, 1/2" [12.70] below center of shaft - Type "A" shaft
- U. L. Approved, File No. E51076 and C. S. A. File No. LR62770

RESIST	ANCE VAL	UES*
TOTAL OHMS	MAXIMUM AMPS	APPROXIMATE STEPS
.5	14.140	30
1.0	10.000	30
2.0	7.071	56
3.0	5.774	66
5.0	4.472	56
7.5	3.652	66
10.0	3.162	104
15.0	2.582	113
25.0	2.000	144
50.0	1.414	180
75.0	1.155	180
100.0	1.000	216
200.0	.707	252
300.0	.557	252
400.0	.500	252
500.0	.447	324
750.0	.365	396
1000.0	.316	410
2000.0	.224	410
2500.0	.200	410
5000.0	.141	685
7500.0	.115	820
10000.0	.100	820



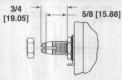


Angstrohm rheostat standard wattage ratings are based on a 300°C rise in "free-air" in ambient not exceeding 40°C (shown). For other applications, wattage ratings are available based on 340°C rise in "free-air" in ambient not exceeding 25°C, and in other cases





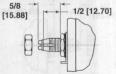
TYPE B: 1/2 [12.70], 11/32 [8.73] Models. Slotted shaft with standard bushing for 1/8 [3.18] panel.



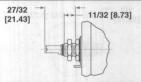
50°C.

DERATING

TYPE C: 3/4 [19.05], 5/8 [15.88] Models. Locking bushing with slotted shaft for 1/4 [6.35] panel



TYPE D: 5/8 [15.88], 1/2 [12.70] Models. Locking bushing with slotted shaft for 1/8 [3.18] panel.



TYPE E: 27/32 [21.43], 11/32 [8.73] Models. Std. bushing and flatted shaft w/screw-driver slot for 1/8 [3.18] panel.

PART MARKING

- Resistance value
- -Amps
- Date code

HOW TO ORDER

MP25 MODEL BUSHING AND SHAFT CONFIGURATION

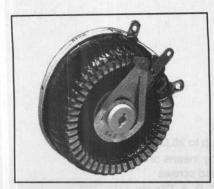
A = Standard Flatted Shaft.

25 VALUE

NOTE: For Additional Features: Submit detailed drawing information when ordering "non-standard" parts.

MODEL MP30 Power Rheostats 150 Watt



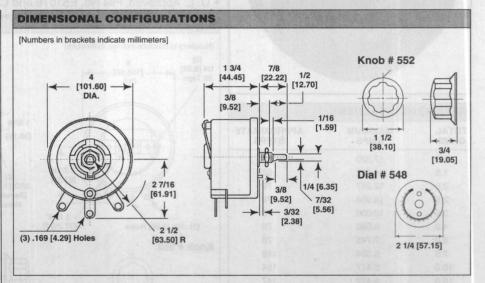


FEATURES

- Diameter 4" [101.60]
- Depth behind panel 1 3/4" [44.45]
- Shaft 1/4" [6.35] diameter
- Rotation 300° ± 5° and weight 1.014 pounds (460 grams)
- Total ohms available in higher ranges up to 25,000 ohms
- Mounts on panels up to 1/4" [6.35] by means of a 3/8" [9.52], 32 bushing and hex nut
- Non-turn lugs require 3/16" [4.76] hole, 1/2" [12.70] below center of shaft - Type "A" shaft
- U. L. Approved, File No. E51076 and C. S. A. File No. LR62770

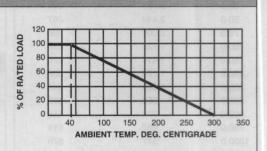
RESISTANCE VALUES*						
TOTAL	MAXIMUM AMPS	APPROXIMATE STEPS				
.5	17.350	35				
1.0	12.247	39				
2.0	8.660	39				
3.0	7.071	70				
5.0	5.477	73				
7.5	4.472	70				
10.0	3.873	70				
15.0	3.162	120				
25.0	2.449	152				
50.0	1.732	190				
75.0	1.414	228				
100.0	1.225	228				
200.0	.866	265				
300.0	.707	303				
400.0	.612	342				
500.0	.548	342				
750.0	.447	418				
1000.0	.387	432				
2000.0	.274	575				
2500.0	.244	456				
5000.0	.173	865				
7500.0	.141	1000				
10000.0	.122	1000				

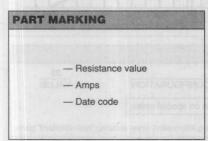
^{*} All other intermediate resistance values are available and can be manufactured on a normal delivery cycle.

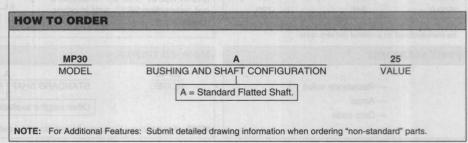


Angstrohm rheostat standard wattage ratings are based on a 300°C rise in "free-air" in ambient not exceeding 40°C (shown). For other applications, wattage ratings are available based on 340°C rise in "free-air" in ambient not exceeding 25°C, and in other cases 50°C.

DERATING







MODEL MP40 Power Rheostats 300 Watt





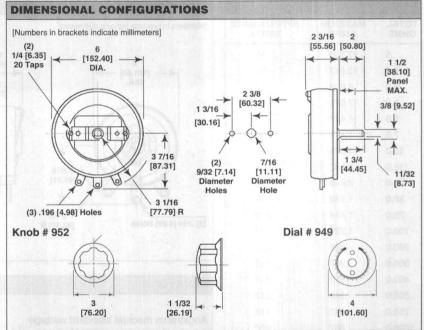
RESISTA	NCE VALUES*	
TOTAL OHMS	MAXIMUM AMPS	APPROXIMATE STEPS
1.0	17.320	40
1.5	14.142	58
2.0	12.247	78
2.5	10.954	78
3.0	10.000	73
4.0	8.660	78
5.0	7.745	78
7.5	6.324	148
10.0	5.477	154
15.0	4.472	147
25.0	3.464	155
35.0	2.927	231
50.0	2.449	267
75.0	2.000	308
100.0	1.732	326
150.0	1.414	270
200.0	1.224	308
300.0	1.000	340
400.0	.886	370
500.0	.774	455
750.0	.632	514
1000.0	.547	578
1500.0	.447	675
2500.0	.346	720

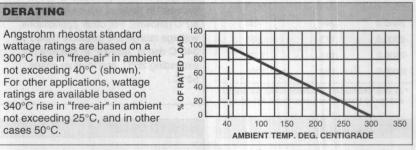
^{*} All other intermediate resistance values are available and can be manufactured on a normal delivery cycle.

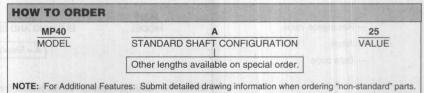
PART MARKING					
	Resistance value Amps Date code				

FEATURES

- Diameter 6" [152.40]
- Depth behind panel 2 3/16" [55.56]
- Shaft 3/8" [9.52] diameter
- Rotation 315° ± 5°
- Type "A" shaft
- Weight 2.625 pounds (1.191 kilograms)
- Total ohms available in higher ranges up to 25,000 ohms
- Mounts on panels up to 1 1/4" [31.75] by means of a mounting bracket with two 1/4" [6.35], 20 flat head screws
- U. L. Approved, File No. E51076 and C. S. A. File No. LR62770







Special Power Rheostats



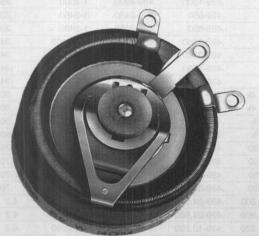




ENCLOSED RHEOSTATS

MODEL MP07, 12.5 Watt derated to 6.25 Watt MODEL MP11, 25 Watt derated to 12.6 Watt

The MP07 and MP11 Rheostats can be furnished in a light-weight, dust-proof metal can, equipped with two or three screw terminals or solder lugs. They are not hermetically sealed but are closed by a rolled double seam. The MP07 is available in resistance values as listed for the MP06 (page 41), and the MP11 is available in resistance values as listed for the MP10 (page 42). How to Order information for the MP07 and the MP11 is the same as the MP06 and the MP10, respectively.



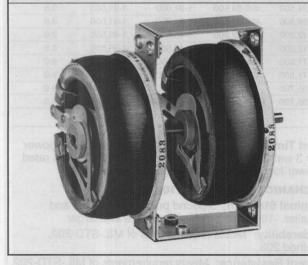
RING TYPE RHEOSTATS

MODEL N152

Angstrohm N152 ring rheostats are especially designed for portable and mobile apparatus likely to be subject to severe shock. Their rugged construction makes them well suited for this use.

FEATURES

- Operation Manual
- Type Rheostat, adjustable
- Duty Continuous
- Enclosure Open
- Service Navy A
- Ambient 50°C
- · Insulation Class C
- · Rating 50 Watt
- Form EW, Exposed Wire or Ribbon



TANDEM ASSEMBLIES

Two or more rheostats may be specified in tandem to save space on the face of a panel. These assemblies are manufactured using a common shaft arrangement which virtually eliminates backlash while providing smooth positive action. Since there are countless tandem combinations possible, consult Angstrohm for information regarding your specific requirements.

			POWER					DALE RANGE (Non-Mil.) (Ohms)		
	DALE	MIL-R-39007	RATING	MILITARY PANICE (Ohmo)		(Ohms)			.5%, 1%,	MAXIMUM WEIGHT
	MODEL	TYPE	(Watts)	.1%	.5 & 1%	.05%	.1%	.25%	3%, 5%	(Grams)
	EGS-1-80	RWR81S	name to be	.499-1000	.1-1000	1-1000	.499-1000	.499-3400	.1-3400	.21
	EGW-1	RWR81W	raut.	.499-1000	.1-1000	1-1000	.499-1000	.499-3400	.1-3400	.21
	EGN-1-80	RWR81N	1	10-499	.1-499	1-500	.499-500	.499-1700	.1-1700	.21
rs.	EGN-1-10	RWR81Z	1	10-499	.1-499	1-500	.499-500	.499-1700	.1-1700	.21
DE	EGS-2	RWR82S	1.5	.499-1300	.1-1300	1-1300	.499-1300	.499-4900	.1-4900	.23
MOLDED MODELS	EGW-2	RWR82W	1.5	.499-1300	.1-1300	1-1300	.499-1300	.499-4900	.1-4900	.23
ED	EGN-2	RWR82N	1.5	.499-649	.1-649	1-650	.499-650	.499-2450	.1-2450	.23
OLD	EGN-2-10	RWR82Z	1.5	.499-649	.1-649	1-650	.499-650	.499-2450	.1-2450	.23
ž	EGS-3-80	RWR80S	2	.499-3160	.1-3160	1-2700	.499-3160	.499-10,400	.1-10,400	.34
	EGW-3	RWR80W	2	.499-3160	.1-3160	1-2700	.499-3160	.499-10,400	.1-10,400	.34
	EGN-3-80	RWR80N	2	10-1580	.1-1580	1-1350	.499-1580	.499-5200	.1-5200	.34
	EGN-3-10	RWR80Z	2	10-1580	.1-1580	1-1350	.499-1580	.499-5200	.1-5200	.34
	ESS-2A	RWR71S	2	.499-12.1k	.1-12.1k	.499-11.4k	.499-11.4k	.1-42.1k	.1-42.1k	.90
	ESW-2A	RWR71W	2	.499-12.1k	.1-12.1k	.499-11.4k	.499-11.4k	.1-42.1k	.1-42.1k	.90
	ESN-2A	RWR71N	2	10-6.04k	.1-6.04k	.499-5.7k	.499-5.7k	.1-21.05k	.1-21.05k	.90
	ESN-2A-10	RWR71Z	2	10-6.04k	.1-6.04k	.499-5.7k	.499-5.7k	.1-21.05k	.1-21.05k	.90
	ESS-2B	RWR89S	3	.499-4120	.1-4120	.499-6500	.499-6500	.1-24,500	.1-24,500	.70
	ESW-2B	RWR89W	3	.499-4120	.1-4120	.499-6500	.499-6500	.1-24,500	.1-24,500	.70
	ESN-2B	RWR89N	3	10-2050	.1-2050	.499-3250	.499-3250	.1-12,250	.1-12,250	.70
S	ESN-2B-10	RWR89Z	3	10-2050	.1-2050	.499-3250	.499-3250	.1-12,250	.1-12,250	.70
MODELS	ESS-5	RWR74S	5	.499-12,100	.1-12,100	.499-24,500	.499-24,500	.1-91,000	.1-91,000	4.2
NOI	ESW-5	RWR74W	5	.499-12,100	.1-12,100	.499-24,500	.499-24,500	.1-91,000	.1-91,000	4.2
EDI	ESN-5	RWR74N	5	10-6040	.1-6040	.499-12,200	.499-12,200	.1-45,500	.1-45,500	4.2
COATED	ESN-5-10	RWR74Z	5	10-6040	.1-6040	.499-12,200	.499-12,200	.1-45,500	.1-45,500	4.2
00	EGS-10-80	RWR84S	7	.499-12,400	.1-12,400	.499-24,500	.499-24,500	.1-91,000	.1-91,000	3.6
	EGW-10	RWR84W	7	.499-12,400	.1-12,400	.499-24,500	.499-24,500	.1-91,000	.1-91,000	3.6
	EGN-10-80	RWR84N	7	10-6190	.1-6190	.499-12,200	.499-12,200	.1-45,500	.1-45,500	3.6
	EGN-10-10	RWR84Z	7	10-6190	.1-6190	.499-12,200	.499-12,200	.1-45,500	.1-45,500	3.6
	ESS-10	RWR78S	10	.499-39,200	.1-39,200	.499-71,500	.499-71,500	.1-265,000	.1-265,000	9.0
	ESW-10	RWR78W	10	.499-39,200	.1-39,200	.499-71,500	.499-71,500	.1-265,000	.1-265,000	9.0
	ESN-10	RWR78N	10	10-19,600	.1-19,600	.499-35,700	.499-35,700	.1-132,500	.1-132,500	9.0
	ESN-10-10	RWR78Z	10	10-19,600	.1-19,600	.499-35,700	.499-35,700	.1-132,500	.1-132,500	9.0

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: .1%, .5%, 1%.

Temperature Coefficient: (- 55°C to + 275°C).

- ± 650PPM/°C, .1 ohm .499 ohm.
- ± 400PPM/°C, .499 ohm 1 ohm.
- ± 50PPM/°C, 1 ohm 10 ohm.
- ± 20PPM/°C, 10 ohm and above.

Dielectric Strength: 500 VAC for 2 watt size and smaller.

1000 VAC for 3 watt size and larger.

Insulation Resistance: 1000 Megohm minimum.

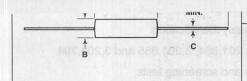
Short Time Overload: 5 seconds at 5 times rated power for 3 watt size and smaller. 5 seconds at 10 times rated power for 5 watt size and larger.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull for 2 watt size and smaller. 10 pound pull for 3 watt size and larger. Solderability: Meets requirements of MIL-STD-202,

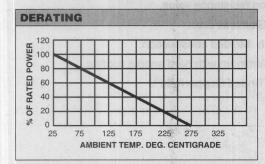
Method 208.

Solvent Resistance: Meets requirements of MIL-STD-202, Method 215.



				The state of the s
ĕ	RWR80	$.422 \pm .015 [10.72 \pm .381]$.110 ± .015 [2.79 ± .381]	$.020 \pm .0015 [.508 \pm .038]$
10	RWR71	.812 ± .062 [20.62 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
A	RWR89	.560 ± .062 [14.22 ± 1.58]	.187 ± .031 [4.75 ± .787]	.032 ± .002 [.813 ± .051]
AT	RWR74	.875 ± .062 [22.23 ± 1.58]	$.312 \pm .031 [7.92 \pm .787]$.040 ± .002 [1.02 ± .051]
00	RWR84	.875 ± .062 [22.23 ± 1.58]	.312 ± .031 [7.92 ± .787]	.040 ± .002 [1.02 ± .051]
	RWR78	1.780 ± .062 [45.21 ± 1.58]	.375 ± .031 [9.52 ± .787]	.040 ± .002 [1.02 ± .051]

ENVIRONMENTAL PERFORI					
TEST	A STATE OF THE STA	TEST CONDITIONS	course in cities	LIMITS	
Power Conditioning		100 hours at rated power and + 25°C		$.2\% + .005\Omega$	
D.C. Resistance		MIL-STD-202, Method 303		Within tolerance	BJA
Visual and Mechanical	BANKERS	Visual inspection	RIA SERT US	THUUM	LISTUD
Dielectric Strength		500 V or 1000 V	2	$.1\% + .005\Omega$	2.44
Solderability		Method 208, MIL-STD-202		95% coverage	
Resistance to Solvents		Method 215, MIL-STD-202		016 CARSE	01-HI
Thermal Shock		Method 107, MIL-STD 202, Condition B		$.2\% + .005\Omega$	STATE OF THE STATE
Short Time Overload		5 seconds at 10 or 5 times rated power	6 G	$.2\% + .005\Omega$	
Insulation Resistance		Method 302, MIL-STD-202, Condition A		1000 Megohm	
Load Life		10,000 hours at rated power + 25°C		1% + .005Ω	
Temperature Coefficient	e.r.	- 55°C to + 275°C		0 ± 650PPM/°C .1Ω499Ω 0 ± 400PPM/°C .499Ω-1Ω	3-HF
				0 ± 50 PPM/°C 1Ω - 10Ω 0 ± 20 PPM/°C 10Ω & up	
Thermal Shock	p d	Method 107, MIL-STD-202, Condition B	4	.2% + .005Ω	Assista
Dielectric Strength		500 V or 1000 V		$.1\% + .005\Omega$	TE STORES
Low Temperature Storage	Wall.	- 65°C for 24 hours	10	$.1\% + .005\Omega$	-00-HF
Moisture Resistance		Method 106, MIL-STD-202	market state of the state of	$.2\% + .005\Omega$	III OTTO
Terminal Strength		5 pound or 10 pound pull		$.1\% + .005\Omega$	
Insulation Resistance		Method 302, MIL-STD-202, Condition A	C. C. C. C.	1000 Megohm	
Thermal Shock	SOPTABL	Method 107, MIL-STD-202, Condition B		.2% + .005Ω	
Shock		Method 205, MIL-STD-202, Condition C	A STREET	.1% + .005Ω	The same of
Vibration	SECTION SECTION	Method 204, MIL-STD-202, Condition D		$.1\% + .005\Omega$	
Reactance		Non-inductive only			91 I I
High Temperature Exposure	and the same of	+ 275°C for 2000 hours	Chan Gt R no	$.5\% + .05\Omega$	hitrole



POWER RATING

Power ratings are based on a maximum ΔR of .5% + .05 ohm when operated for 2000 hours at rated power and at an ambient of + 25°C.

PART MARKING

- Source code
- Date code, lot code and "JAN" marking
- Style
- Terminal non-inductive designator and resistance value
- Tolerance and failure rate

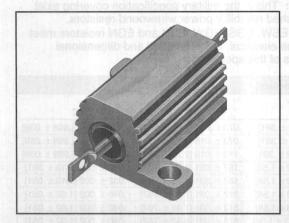
HOW TO ORDER

RWR74	S	49R9	F	M
MILITARY	TERMINAL WIRE	RESISTANCE	RESISTANCE	FAILURE
TYPE	AND WINDING		TOLERANCE	RATE

MODELS ERH and ENH Wirewound Resistors

Military/Established Reliability, MIL-R-39009 Qualified, Type RER, R Level





FEATURES

- Aluminum housed
- Standard (ERH) or non-inductive (ENH) winding
- Molded construction gives complete environmental protection
- · Complete welded construction
- · Mounts on chassis to utilize heat sink effect
- · High stability at conventional power ratings
- Flat marking surface for easy identification
- Covered by U.S. Patents 201,884, 3,201,855 and 3,206,704
- · 100% power stabilization and screening tests

DALE	MIL D 20000	POWER RATING (Watts)		MILITARY RESISTANCE RANGE (Ohms)	CE MAX.	MAX.	MIL-R-39009 STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms)		
DALE MODEL	MIL-R-39009 TYPE	MOUNTED	FREE AIR	1%	VOLTAGE	(Grams)	± 100PPM	± 50PPM	± 30PPM
ENH-5	RER40	5	3	1-1.65k	128.9	3.3	v = 1 	1-19.9	20-1.65k
ENH-10	RER45	10	6	1-2.8k	190.0	8.8		1-19.9	20-2.8k
ENH-25	RER50	20	8	1-6.04k	390.0	16.5		1-19.9	20-6.04k
ENH-50	RER55	30	10	1-19.6k	890.0	35.0		1-19.9	20-19.6k
ERH-5	RER60	5	3	0.10-3.32k	160.0	3.0	.199	1-19.9	20-3.32k
ERH-10	RER65	10	6	0.10-5.62k	265.0	6.0	.199	1-19.9	20-5.62k
ERH-25	RER70	20	8	0.10-12.1k	550.0	13.0	.199	1-19.9	20-12.1k
ERH-50	RER75	30	10	0.10-39.2k	1250.0	28.0	.199	1-19.9	20-39.2k

ELECTRICAL SPECIFICATIONS

Tolerance: Only military specification tolerance available is \pm 1%.

Dielectric Strength: 1000 VAC on 5, 10 and 25 watt units. 2,000 VAC on 30 watt units.

Insulation Resistance: 10,000 Megohm minimum dry, 1,000 Megohm minimum after moisture test.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 lb. pull test on 5 and 10 watt units. 10 lb. pull test on 20 and 30 watt units.

Solderability: Satisfactory when tested in accordance with Method 208 of MIL-STD-202.

MATERIAL SPECIFICATIONS

Core: Ceramic: Steatite or alumina, depending on physical size.

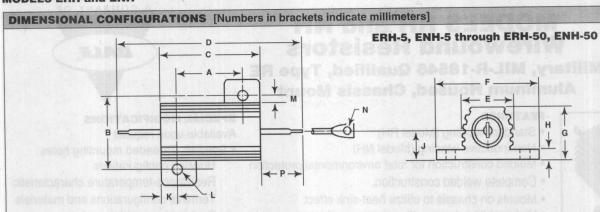
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Stainless steel.

Encapsulant: Molded construction.

Housing: Aluminum with hard anodic coating.

Terminals: Tinned Copperweld®.



MODEL	A	В	С	D	E	F	G	Н	J	K	L	M	N	Р
ERH-5 ENH-5	.444 ± .005 [11.28 ± .127]	.490 ± .005 [12.45 ± .127]	.600 ± .031 [15.24 ± .787]	1.125 ± .062 [28.58 ± 1.57]	.334 ± .015 [8.48 ± .381]	.646 ± .015 [16.41 ± .381]	.320 ± .015 [8.13 ± .381]	.065 ± .010 [1.65 ± .254]	.133 ± .010 [3.38 ± .254]	.078 ± .010 [1.98 ± .254]	.093 ± .005 [2.36 ± .127]	.078 ± .015 [1.98 ± .381]	.050 ± .005 [1.27 ± .127]	.266 ± .062 [6.76 ± 1.57]
ERH-10 ENH-10	.562 ± .005 [14.27 ± .127]	.625 ± .005 [15.88 ± .127]	.750 ± .031 [19.05 ± .787]	1.375 ± .062 [34.93 ± 1.57]	.420 ± .015 [10.67 ± .381]	.800 ± .015 [20.32 ± .381]	.390 ± .015 [9.91 ± .381]	.075 ± .010 [1.90 ± .254]	.165 ± .010 [4.19 ± .254]	.093 ± .010 [2.36 ± .254]	.094 ± .005 [2.39 ± .127]	.102 ± .015 [2.59 ± .381]	.085 ± .005 [2.16 ± .127]	.312 ± .062 [7.92 ± 1.57]
ERH-25 ENH-25	.719 ± .005 [18.26 ± .127]	.781 ± .005 [19.84 ± .127]	1.062 ± .031 [26.97 ± .787]	1.938 ± .062 [49.23 ± 1.57]	.550 ± .015 [13.97 ± .381]	1.080 ± .015 [27.43 ± .381]	.546 ± .015 [13.87 ± .381]	.075 ± .010 [1.90 ± .254]	.231 ± .010 [5.87 ± .254]	.172 ±.010 [4.37 ±.254]	.125 ± .005 [3.18 ± .127]	.115 ± .015 [2.92 ± .381]	.085 ±.005 [2.16 ±.127]	.438 ± .062 [11.13 ± 1.57]
ERH-50 ENH-50	1.562 ± .005 [39.67 ± .127]	.844 ± .005 [21.44 ± .127]	1.968 ± .031 [49.99 ± .787]	2.781 ± .062 [70.64 ± 1.57]	.630 ± .015 [16.00 ± .381]	1.140 ± .015 [28.96 ± .381]	.610 ± .015 [15.49 ± .381]	.088 ± .010 [2.24 ± .254]	.260 ± .010 [6.60 ± .254]	.196 ±.010 [4.98 ±.254]	.125 ± .005 [3.18 ± .127]	.107 ±.015 [2.72 ±.381]	.085 ± .005 [2.16 ± .127]	.438 ± .062 [11.13 ± 1.57]

NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

ENVIRONMENTAL PERFORMANCE

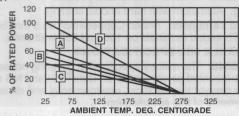
GENERAL: Testing of ERH and ENH resistors is done according to the procedures and test methods described in MIL-R-39009. The table below shows the military and the Dale® performance requirements.

THE table below shows the h	ilitary art	Tille Dale per	torritation requirements.			
TEST		008	MIL-R-39009	48.06.7h	30	DALE TYPICAL
Temperature Coefficient			\pm 30PPM 20Ω and up \pm 50PPM 1Ω to 19.60Ω \pm 100PPM below 1Ω			See Table
Thermal Shock	654	0861	\pm (.3% + 0.01Ω) ΔR	. 5-25k	75	\pm (.2% + 0.01Ω) ΔR
Short Time Overload			\pm (.3% + 0.01Ω) ΔR			\pm (.15% + 0.01Ω) ΔR
Dielectric			\pm (.2% + 0.01Ω) ΔR	WG I I -O		\pm (.2% + 0.01Ω) ΔR
High Temperature Storage (2 hours)	r.on	acar.	\pm (.5% + 0.01Ω) ΔR		000	\pm (.25% + 0.01Ω) ΔR
High Temperature Exposure (2,000 hou	rs)		± (1% + 0.01Ω) ΔR			\pm (.75% + 0.01Ω) ΔR
Moisture Resistance			\pm (.5% + 0.01Ω) ΔR			\pm (.25% + 0.01Ω) ΔR
Shock	DOM: DATES		\pm (.2% + 0.01Ω) ΔR	Date yelling		\pm (.1% + 0.01Ω) ΔR
Vibration			\pm (.2% + 0.01Ω) ΔR			\pm (.1% + 0.01 Ω) Δ R
Load Life (2,000 hours)	AGITICA	HIR JAON	± (1% + 0.01Ω) ΔR		HOITA	\pm (.5% + 0.01Ω) ΔR
Terminal Strength	lug idi B	disenging	\pm (.2% + 0.01Ω) ΔR	aray, Jeca	1007 100	\pm (.1% + 0.01Ω) ΔR

DERATING

ERH and ENH resistors have an operating temperature range of -55°C to + 275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. The following curves apply to operation of unmounted resistors:

- A = ERH-5, ENH-5, ERH-10, ENH-10, unmounted.
- B = ERH-25, ENH-25, unmounted.
- C = ERH-50, ENH-50, unmounted.
- D = All types mounted to aluminum chassis.



POWER RATING

 $\mathsf{Dale}^{\circledast} \mathsf{ERH}$ and ENH resistor ratings are based on the following requirements:

- 1. 275°C maximum internal hotspot temperature.
- 2. 1% maximum ΔR in 2000 hour load life.
- 3. Proper heat sink:

4 x $\stackrel{\cdot}{6}$ x $\stackrel{\cdot}{2}$ x .040 aluminum chassis for ERH-5, ENH-5, ERH-10 and ENH-10.

 $5\times7\times2\times.040$ aluminum chassis for ERH-25, ENH- 25, ERH-50 and ENH-50.

PART MARKING

- JAN
- **—** 91637
- Value and tolerance
- Mil mark
- Date/lot code

MODELS RH and NH Wirewound Resistors

Military, MIL-R-18546 Qualified, Type RE Aluminum Housed, Chassis Mount





FEATURES

- Standard winding (Model RH)
- Non-inductive winding (Model NH)
- Molded construction for total environmental protection
- · Complete welded construction
- · Mounts on chassis to utilize heat-sink effect
- High stability at conventional power ratings
- Flat marking surface for easy identification

SPECIAL MODIFICATIONS

Available upon request

Special: Threaded mounting holes
 Housing configurations
 Resistance-temperature characteristic
 Terminal configurations and materials
 Resistances and tolerances

Pre-conditioning

DALE	MIL-R- 18546		R RATING		ESISTANCE RANGE SHO		the second secon	MAX. WORKING	MAX. WEIGHT	STANDARD TEMP. COEFFICIEN VALUE RANGES (Ohms)*		
MODEL	TYPE	DALE	MILITARY	.05%, .1%	.25%	.5%	1%, 3%, 5%	VOLTAGE	(Grams)	± 50PPM	± 30PPM	± 20PPM
RH-5	RE60G	7.5 (5)	5	.26-6.75k	.05-24.5k	.02-24.5k	.02-24.5k .10-3.32k	160	3	1-9.9	10-49	50-24.5k
NH-5	RE60N	7.5 (5)	5	.26-3.4k	.05-12.25k	.05-12.25k	.05-12.75k 1.0-1.65k	110	3.3	1-9.9	10-25	26-12.25
RH-10	RE65G	12.5 (10)	10	.16-12.7k	.05-47.1k	.01-47.1k	.01-47.1k .10-5.62k	265	6	1-9.9	10-79	80-47.1k
NH-10	RE65N	12.5 (10)	10	.16-6.4k	.05-23.5k	.05-23.5k	.05-23.5k 1.0-2.8k	190	8.8	1-9.9	10-40	41-23.5k
RH-25	RE70G	25	20	.16-25.7k	.05-95.2k	.01-95.2k	.01-95.2k .10-12.1k	550	13	1-9.9	10-169	170-95.2
NH-25	RE70N	25	20	.16-12.8k	.05-47.6k	.05-47.6k	.05-47.6k 1.0-6.04k	390	16.5	1-9.9	10-85	86-47.6k
RH-50	RE75G	50	30	.16-73.4k	.064-273k	.01-273k	.01-273k .10-39.2k	1250	28	1-9.9	10-469	470-273k
NH-50	RE75N	50	30	.16-36.7k	.064-136k	.064-136k	.05-136k 1.0-19.6k	890	35	1-9.9	10-235	236-136k
RH-100	RE77G	100	75	.5-90k	.1-90k	.05-90k	.05-90k . 05-29.4k	1900	400	1-99	100-949	950-90k
NH-100	RE77N	100	75	.5-25k	.1-25k	.05-25k	.05-37.5k 1.0-14.7k	1350	440	1-49	50-475	476-375k
RH-250	RE80G	250	120	.5-116k	.1-116k	.1-116k	.05-116k .10-35.7k	2300	800	1-99	100-999	1k-116k
NH-250	RE80N	250	120	.5-37.5k	.1-37.5k	.1-37.5k	.05-48.5k 1.0-17.4k	1625	880	1-49	50-499	500-48.5

^{* .1} ohm to .99 ohm = \pm 100PPM

NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated. Figures in parentheses on RH-5 and RH-10 indicate wattage printed. New construction allows these resistors to be rated at 7.5 and 12.5 watts, but they will be printed with these higher ratings only upon customer request.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 3%, 1%, .5%, .25%, .10%, .05%.

Operating Temperature Range: - 55°C to + 275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. (See Derating Curve.)

Power Rating: Ratings are based on these requirements:

- 1. 275°C maximum internal hotspot temperature.
- 2. 1% max. ΔR in 1000 hour load life for RH-5 thru RH-50. 3% max. ΔR in 1000 hour load life for RH-100 and RH-250.
- 3. Proper heat sink:

4 x 6 x 2 x .040 aluminum chassis = 5 and 10 watt units. 5 x 7 x 2 x .040 aluminum chassis = 25 watt units. 12 x 12 x .059 aluminum panel = 50 watt units.

12 x 12 x .125 aluminum panel = 100 and 250 watt units.

Dielectric Strength: 1000 VAC = 5, 10, 25 watt units. 2000 VAC = 50 watt units. 4500 VAC = 100, 250 watt units.

Insulation Resistance: 10,000 Megohm minimum dry, 1,000 Megohm minimum after moisture test.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 lb. pull test = RH-5, NH-5, RH-10, NH-10. 10 lb. pull test = RH-25 thru RH-250, NH-25 thru NH-250.

Solderability: Satisfactory when tested in accordance with Method 208 of MIL-STD-202.

MATERIAL SPECIFICATIONS

Core: Ceramic steatite or alumina, depending on physical size.

Element: Copper-nickel alloy, nickel-chrome alloy or manganese copper, depending on resistance value.

End Caps: Stainless steel.

Encapsulant: Silicone molded construction. **Housing:** Aluminum with hard anodic coating.

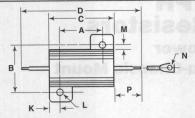
Standard Terminals: Tinned Copperweld® on 5 thru 50 watt units. Threaded terminals on 100 and 250 watt units.

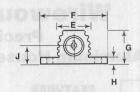
APPLICABLE MIL-SPECIFICATIONS

MIL-R-18546: The military specification covering housed chassis-mounted power resistors. Dale[®] RH and NH resistors meet or exceed the electrical, environmental and dimensional requirements of this specification.

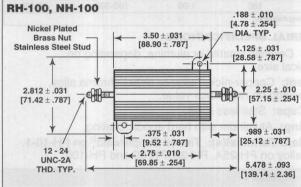
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

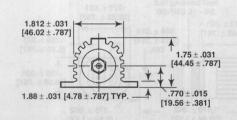
RH-5, -10, -25, -50 NH-5, -10, -25, -50

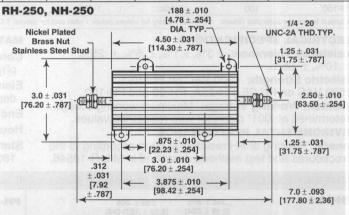


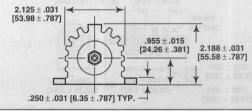


TYPE	Α	В	С	D	E	F	G	Н	J	K	nal Lno	M	N	P
RH-5	.444	.490	.600	1.125	.334	.646	.320	.065	.133	.078	.093	.078	.050	.266
NH-5	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005	±.062
	[11.28	[12.45	[15.24	[28.58	[8.48	[16.41	[8.13	[1.65	[3.38	[1.98	[2.36	[1.98	[1.27	[6.76
	±.127]	±.127]	± .787]	± 1.57]	± .381]	±.381]	±.381]	± .254]	± .254]	± .254]	±.127]	±.381]	±.127]	± 1.57]
RH-10	.562	.625	.750	1.375	.420	.800	.390	.075	.165	.093	.094	.102	.085	.312
NH-10	±.005	±.005	± .031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005	±.062
	[14.27	[15.88	[19.05	[34.93	[10.67	[20.32	[9.91	[1.90	[4.19	[2.36	[2.39	[2.59	[2.16	[7.92
	±.127]	±.127]	± .787]	± 1.57]	± .381]	± .381]	± .381]	± .254]	± .254]	± .254]	±.127]	± .381]	±.127]	± 1.57]
RH-25	.719	.781	1.062	1.938	.550	1.080	.546	.075	.231	.172	.125	.115	.085	.438
NH-25	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005	±.062
	[18.26	[19.84	[26.97	[49.23	[13.97	[27.43	[13.87	[1.90	[5.87	[4.37	[3.18	[2.92	[2.16	[11.13
	±.127]	±.127]	±.787]	± 1.57]	±.381]	±.381]	± .381]	± .254]	± .254]	±.254]	±.127]	± .381]	±.127]	± 1.57]
RH-50	1.562	.844	1.968	2.781	.630	1.140	.610	.088	.260	.196	.125	.107	.085	.438
NH-50	±.005	±.005	±.031	±.062	±.015	±.015	±.015	±.010	±.010	±.010	±.005	±.015	±.005	± .062
	[39.67	[21.44	[49.99	[70.64	[16.00	[28.96	[15.49	[2.24	[6.60	[4.98	[3.18	[2.72	[2.16	[11.13
	± .127]	± .127]	± .787]	± 1.57]	± .381]	± .381]	± .381]	± .254]	± .254]	± .254]	± .127]	± .381]	± .127]	± 1.57]









ENVIRONMENTAL PERFORMANCE

General: Testing is done according to the procedures and test methods described in MIL-R-18546. The table below shows the military and the Dale performance requirements. All specifications are based on testing of 1% tolerance units.

TEST	MIL-R-18546 REQUIREMENT	TYPICAL CHANGE
Temperature Coefficient	\pm 50PPM 2000 Ω \pm 30PPM over 2000 Ω	See Table
Thermal Shock	\pm (.5% + 0.01Ω) ΔR	\pm (.25% + 0.01Ω) ΔR
Short Time Overload	\pm (.5% + 0.01Ω) ΔR	\pm (.25% + 0.01Ω) ΔR
Dielectric	\pm (.2% + 0.01Ω) ΔR	\pm (.1% + 0.01Ω) ΔR
High Temperature Storage	\pm (.5% + 0.01Ω) ΔR	\pm (.25% + 0.01Ω) ΔR
Moisture Resistance	\pm (1% + 0.01Ω) ΔR	\pm (.5% + 0.01Ω) ΔR
Shock	\pm (.2% + 0.01Ω) ΔR	\pm (.1% + 0.01Ω) ΔR
Load Life	\pm (1% + 0.01Ω) ΔR	\pm (.5% + 0.01Ω) ΔR
Vibration	\pm (.2% + 0.01Ω) ΔR	\pm (.1% + 0.01Ω) ΔR
Terminal Strength	\pm (.2% + 0.01Ω) ΔR	\pm (.1% + 0.01Ω) ΔR

DERATING The following curve

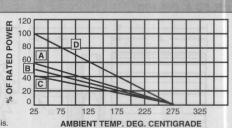
The following curves apply to operation of unmounted resistors:

A = 5 &10 watt units, unmounted.

B = 25 watt units, unmounted. C = 50, 100 & 250

unmounted. **D** = All types mounted to aluminum chassis.

watt units.

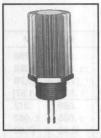


Date code

MODEL PH Wirewound Resistors

Precision Power Aluminum Housed, Thru-Chassis Mount





FEATURES

- · Complete welded construction
- · Complete environmental protection
- · Designed to utilize heat-sink effect of chassis
- · Plug-in connections available for quick connect/disconnect from circuit

MODEL PH-10-1		RATING	RESISTANCE RANGES (Ohms) *		MAX. WORKING	MAX. WEIGHT	STANDARD TEMPERATURE COEFFICIENT VALUE RANGES (Ohms) †			
		(Watts)	.05%, .1%, .25%	.5%, 1%, 3%	VOLTAGE	(Grams)	± 50PPM	± 30PPM	± 20PPM	
PH-10-1	880	10	1-12.7k	.1-47.1k	240	6	1-9.9	10-79	80-47.1k	
PH-25	600	25	.5-25.7k	.1-95.2k	550	22	1-9.9	10-169	170-95.2	
PH-25A	A LUSS	25	.5-25.7k	.1-95.2k	550	22	1-9.9	10-169	170-95.2	
PH-50	Day	50	3-52k	.1-75k	1500	80	1-99	100-999	1k-75k	
PH-100		100	5-35k	.1-50k	1700	186	1-99	100-999	1k-50k	

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 3%, ± 1%, ± .5%, ± .25%,

±.10%, ±.05%.

Dielectric Strength: 1000 VAC on PH-10-1. 2500 VAC on PH-25, PH-25A, PH-50 and PH-100.

Maximum Working Voltage: Maximum working voltage determined at .001" diameter wire resistance values.

ENVIRONMENTAL PERFORMANCE

General: Testing of PH resistors is done according to the procedures and test methods described in MIL-R-18546.

MATERIAL SPECIFICATIONS

Core: Ceramic steatite or alumina, depending on

physical size.

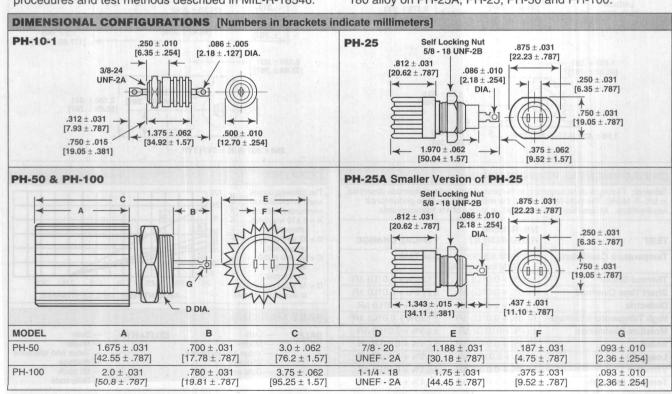
Element: Copper-nickel alloy or nickel-chrome alloy,

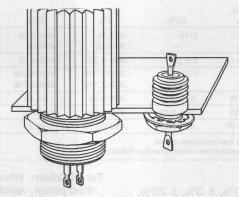
depending on resistance value.

End Caps: Stainless steel.

Housing: Aluminum with hard anodic coating.

Standard Terminal(s): Tinned Copperweld® on PH-10-1. 180 alloy on PH-25A, PH-25, PH-50 and PH-100.





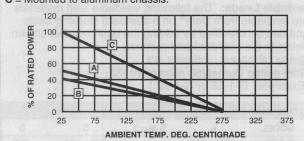
Two Terminal Configurations (PH-10-1, PH-25, PH-50 and PH-100)

Thru chassis mounting

DERATING

Dale PH resistors have an operating temperature range of - 55°C to + 275°C. Derating is required for reduced chassis mounting area and for high ambient temperatures. The following curves apply to the operation of unmounted resistors:

A = PH-10-1, PH-25, unmounted. **B** = PH-50, PH-100, unmounted. **C** = Mounted to aluminum chassis.



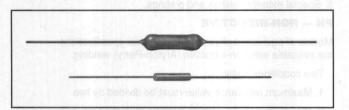
PART MARKING — Dale — Style — Value and tolerance — Wattage — Date code

PH-100 10 1% MODEL RESISTANCE TOLERANCE

MODEL G Wirewound Resistors

Military, MIL-R-26 Qualified, Type RW Precision Power, Silicone Coated and Molded





FEATURES

- From 1.4 to 4 times higher power ratings than conventional resistors of equivalent size
- Completely welded construction
- High temperature silicone coated and molded
- Available in non-inductive styles (Type GN)
- Covered by U.S. Patent 3,295,090

		DALER	ATING			RANGE (Ohms		MAXI	MUM *	
		U	V		MIL. Range sh	own in bold fac	e	WOR		MAXIMUM
MODEL G-1-80	MIL-R-26 TYPE	.05% thru 5%	3% & 5%	.05%	.1%	.25%	.5%,1%, 3%, 5%	U	V	WEIGHT (Grams)
G-1-80	RW81	1.0 W 1.0 W		1-1k	.499-1k . 499-1k	.499-3.4k . 499-1k	.1-3.4k . 1-1k	33 33		.20 .20
G-2		1.5 W	- K	1-1.3k	.499-1.3k	.499-4.9k	.1-4.9k	42	-	.21
G-3-80	RW80	2.0 W 2.0 W		1-2.74k —	.499-2.74k .499-2.74k	.499-10.4k . 499-2.74k	.1-10.4k . 1-2.74k	80 80		.34 .34
G-5		4.0 W	5.0 W	.499-6.5k	.499-6.5k	.1-24.5k	.1-24.5k	162	184	.80
G-5C	_ 1 S	5.0 W	7.0 W	.499-8.6k	.499-8.6k	.1-32.3k	.1-32.3k	194	230	1.20
G-10	10 - 10 m	7.0 W	10.0 W	.499-25.7k	.499-25.7k	.1-95.2k	.1-95.2k	425	508	3.60

* Maximum working voltage determined at .0008" diameter wire resistance values.
NOTE: All resistance ranges shown conform to military specifications unless otherwise indicated.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 5%, \pm 3%, \pm 1%, \pm .5%, \pm .25%, \pm .10%, \pm .05%.

Temperature Coefficient: ± 90PPM/°C, below 1 ohm. ± 50PPM/°C, 1 ohm - 9.9 ohm. ± 20PPM/°C, 10 ohm and above. Consult factory for special T.C. requirements.

Dielectric Strength: 500 VAC for G-1-80, G-2, G-3-80 models. 1000 VAC for all others.

Insulation Resistance: 1000 Megohm minimum dry, 100 Megohm minimum after moisture test.

Short Time Overload: 5 seconds at 5 times rated power = G-1-80 thru G-5C (Characteristic U). 5 seconds at 10 times rated power = all others.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test = G-1-80, G-2 and G-3-80. 10 pound pull test = all others.

Solderability: MIL-R-26 Type - Meets requirements of MIL-STD-202, Method 208. Standard G (Non-MIL Models) - 60/40 electro tin plated terminals to facilitate soldering.

Termination: When G resistors will be operated at full rated power, resistance welding or high temperature solder are the recommended termination methods. Termination should be made within 1/2 inch from end of resistor body.

MATERIAL SPECIFICATIONS

Core: Beryllium oxide or alumina depending on power requirements.

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone. Standard Terminals: Tinned Copperweld®.

Weldable Leads: The following weldable lead materials are available from Dale[®] on a standard stocking basis and can be specified by adding the dash number shown below to the standard part number.

Grade "A" Nickel, untinned -53. Gold-plated Dumet (50 microinch) -52. (Example: G-1-53 or G-1-52.)

Molded Model	URATIONS [Numbers in brackets		MODEL	A	B (Max.)	С	D
₩olded Wodel	— A → [38.10] → MIN.		G-1-80	.250 ± .015 [6.35 ± .381]		.078 ± .015 [1.98 ± .381]	.020 [.508]
	*	MOLDED	G-2	.312±.015 [7.92±.381]		.078 ± .015 [1.98 ± .381]	.020 [.508]
† c	D ± .002 [.051]	Σ	G-3-80	.422 ± .015 [10.72 ± .381]		.110±.015 [2.79±.381]	.020 [.508]
Coated Model	— A → ← [38.10] MIN. →	01	G-5	.562 ± .062 [14.27 ± 1.57]	.640 [16.26]	.188 ± .032 [4.78 ± .813]	.032 [.813]
	***	СОАТЕВ	G-5C	$.500 \pm .062$ [12.70 \pm 1.57]	.593 [15.06]	.218 ± .032 [5.54 ± .813]	.040 [1.02]
4	- B MAX. → C D ± .002 [.051]	8	G-10	.875 ± .062 [22.23 ± 1.57]	1.0 [25.40]	.312 ± .032 [7.92 ± .813]	.040

APPLICABLE MIL-SPECIFICATIONS

MIL-R-26E: This is a military specification designed especially for precision and non-precision power wirewound resistors. The G models meet the requirements of this specification as well as the older MIL-R-26C and MIL-R-23379 specifications.

SPECIAL MODIFICATIONS

- 1. Terminals can be supplied in any commercial material with several type finishes.
- 2. Terminal lengths and diameters can be varied.
- 3. Various elements available for special T.C.
- 4. Special configuration available on request.
- 5. Tolerances available to .01% on most types.
- 6. Special matching available (T.C. and tolerance).

GN - NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by adding the letter N to the letter G in the part number (GN-5, for example). Three conditions apply:

- 1. For GN Types, divide maximum resistance values by two.
- 2. For GN Types, multiply maximum working voltage by .707.
- 3. For GN Types, maximum weights may slightly exceed those shown on low values.

GN-1-80	GN-5
GN-2	GN-5C*
GN-3-80	GN-10

^{*} Body O.D. may exceed that of the G-5C by .010" [.254].

ENVIRONMENTAL PER	REFORMANCE *					
MIL-R-26E TEST REQUIREMENT DALE MAXIM						
Moisture Resistance	\pm (.2% + .05 Ω) Δ R	± (.2% + .05Ω) ΔR				
Load Life	\pm (.5% $+$.05 Ω) Δ R	\pm (.5% + .05 Ω) Δ R				
Temperature Coefficient	30-90PPM/°C Max.	See Elec. Specs.				
Thermal Shock	$\pm (.2\% + .05\Omega) \Delta R$	\pm (.2% + .05 Ω) Δ R				
Short Time Overload	$\pm (.2\% + .05\Omega) \Delta R$	± (.2% + .05Ω) ΔR				
Dielectric	$\pm (.1\% + .05\Omega) \Delta R$	\pm (.1% + .05Ω) ΔR				
Low Temperature Storage	\pm (.2% + .05 Ω) Δ R	± (.2% + .05Ω) ΔR				
High Temperature Exposure	$\pm (.5\% + .05\Omega) \Delta R$	± (.5% + .05Ω) ΔR				
Shock	\pm (.1% + .05 Ω) Δ R	± (.1% + .05Ω) ΔR				
Vibration	$\pm (.1\% + .05\Omega) \Delta R$	± (.1% + .05Ω) ΔR				
Terminal Strength	\pm (.1% + .05Ω) ΔR	± (.1% + .05Ω) ΔR				

^{*} All ΔR figures shown are maximum, based on units with an initial tolerance of 1% and maximum operating temperature of 275°C.

DERATING Ambient Temperature: Dale G coated resistors have an operating temperature range of - 55°C to + 350°C. Dale G molded resistors have an operating temperature range of - 55°C to + 275°C. They must be derated at higher temperatures according to the curve below. 120 RATED POWER 100 80

CHAR II

125

175 AMBIENT TEMP. DEG. CENTIGRADE

CHAR V

225 275 350

CHARACTERISTIC U:

60 40

% OF 20

Coated or molded resistors are available in any tolerance.

CHARACTERISTIC V:

Coated resistors are available in 3% and 5% tolerance.

POWER RATING

Power ratings of Dale G resistors are 1.4 to 4 times higher than those of conventional wirewound resistors of equivalent size. At the higher ratings, Dale G resistors will meet the same environmental and life stability requirements of the lower rated conventional resistors.

CHARACTERISTIC U:

- 1. 275°C maximum hotspot temperature.
- 2. .5% maximum ΔR in 2000 hour load life.

CHARACTERISTIC V:

- 1. 350°C maximum hotspot temperature.
- 2. 3% maximum ΔR in 2000 hour load life.

PART MARKING - Dale - Value — Tolerance Date code

HOW TO ORDER

G-3-80 MODEL RESISTANCE

1% TOLERANCE ranure rate or less than 0.0066% per 1000 hours (at 60% confidence) with full rated power at 25°C. A failure is defined as \pm 1% resistance change.

Coated models: RS-2, 2B, 2C, 5, 7 and 10. Molded models: RS-1/8 thru RS-1A.

			DALE F	RATING	RESISTANCE RANGE (Ohms) ATING MIL. Range shown in bold face					MAXIMUM * WORKING	
	DALE	MIL-R-26 TYPE	.05% thru 5%	V 3% & 5%	.05%	.1%	.25%	.5%, 1%, 3%, 5%	VOLT	V	WEIGHT (Grams)
	RS-1/8		.125 W	10-11		FATE OF LES		.1-1.4K	8.5	-	.15
MOLDED	RS-1/4		.4 W	11-19	1-1k	.499-1k	.499.3.4k	.1-3.4k	20	Control House	.21
2	RS-1/2	L VLOAHO!	.75 W	11-18	1-1.3k	.499-1.3k	.499-4.9k	.1-4.9k	29		.23
M	RS-1A	RW70	1.0 W 1.0 W	1	1-2.74k	.499-2.74k . 499-2.74k	.499-10.4k .499-2.74k	.1-10.4k . 1-2.74k	52		.34
	RS-2	_	4.0 W	5.5 W	.499-12.7k	.499-12.7k	.1-47.1k	.1-47.1k	210	250	2.10
	RS-2B**	RW79	3.0 W 3.0 W	3.75 W	.499-6.5k	.499-6.5k . 499-6.49k	.1-24.5k .1-6.49k	.1-24.5k .1-6.49k	140	157	.70 —
	RS-2C	Distriction St	2.5 W	3.25 W	.499-8.6k	.499-8.6k	.1-32.3k	.1-32.3k	138	157	1.6
	RS-2C-17	-	2.5 W	3.25 W	.499-8.6k	.499-8.6k	.1-32.3k	.1-32.3k	138	157	1.6
	RS-2C-23***	RW69	2.5 W 2.5 W	3.25 W 3.25 W	USBOO - CHAN	84 0320 mm	==	.1-19.9k . 1-2.0k	130 130	150 150	1.6 1.6
0	RS-5**	in 3% and	5.0 W	6.5 W	.499-25.7k	.499-25.7k	.1-95.2k	.1-95.2k	360	410	4.2
COATED	RS-5-69	RW74	5.0 W 5.0 W	6.5 W	.499-24.5k	.499-24.5k . 499-24.3k	.1-91.0k . 1-24.3k	.1-91.0k . 1-24.3k	350	400	4.2
ŏ	RS-5-70***	RW67	5.0 W 5.0 W	6.5 W 6.5 W	E	=		.1-58.5k . 1-8.5k	320 320	365 365	4.2 4.2
-	RS-7		7.0 W	9.0 W	.499-41.4k	.499-41.4k	.1-154k	.1-154k	504	576	4.7
VE	RS-10		10.0 W	13.0 W	.499-73.4k	.499-73.4k	.1-273k	.1-273k	858	978	9.0
	RS-10-38	RW78	10.0 W 10.0 W	13.0 W	.499-71.5k	.499-71.5k . 499-71.5k	.1-265k . 1-71.5k	.1-265k .1-71.5k	846	966	9.0
7	RS-10-39***	RW68	10.0 W 10.0 W	13.0 W 13.0 W	=	三三	工	.1-167k . 1-20k	765 765	875 875	9.0 9.0

^{**} Values available down to .005 ohm in 1%, 3% and 5% tolerances.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: $\pm 5\%$, $\pm 3\%$, $\pm 1\%$, $\pm .5\%$, $\pm .25\%$, ±.1%, ±.05%.

Temperature Coefficient:

- ±90PPM/°C, below 1 ohm.
- ±50PPM/°C, 1 ohm 9.9 ohm.
- ±20PPM/°C, 10 ohm and above.

(Consult factory for special T.C. requirements.)

Dielectric Strength: 500 VAC for RS-1/8 through RS-1A

models. 1000 volts for all others.

Insulation Resistance: 1000 Megohm minimum dry.

100 Megohm minimum after moisture test.

Short Time Overload: 5 seconds at 5 times rated power for 3.25 watt size and smaller. 5 seconds at 10 times rated power for 4 watt size and larger.

MECHANICAL SPECIFICATIONS

Solderability: MIL-R-26 Type - Meets requirements of MIL-STD-202, Method 208. Standard RS (Non-MIL Styles)-60/40 electro tin plated terminals to facilitate soldering.

Terminal Strength: 5 pound pull test = RS-1/8 thru RS-1A models. 10 pound pull test = all others.

MATERIAL SPECIFICATIONS

Core: Ceramic, steatite or alumina, depending on physical size.

Element: Copper-nickel alloy or nickel-chrome alloy

depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone. Standard Terminals: Tinned Copperweld®.

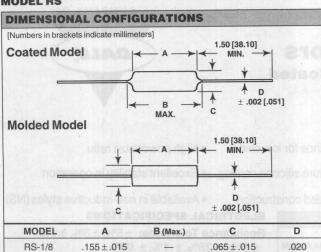
Weldable Leads: The following weldable lead materials are available from Dale® on a standard stocking basis and can be specified by adding the dash number shown below to the standard part number. Consult factory for charges on special lead materials.

Grade "A" Nickel, untinned -53 (Example: RS-1A-53).

Gold-plated Dumet (50 microinch) -52 (Example: RS-1A-52).

Deviations for RS-1/8: Endcaps will be nickel-silver alloy and terminals will be tinned copper.

MODEL RS

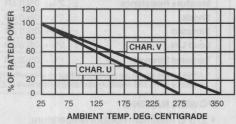


1	MODEL	A	B (Max.)	C	D
	RS-1/8	$.155 \pm .015$ [3.94 $\pm .381$]		$.065 \pm .015$ [1.65 \pm .381]	.020 [.508]
MOLDED	RS-1/4	$.250 \pm .015$ [6.35 \pm .381]	beigw 1 c	$.078 \pm .015$ [1.98 \pm .381]	.020 [.508]
MOL	RS-1/2	.312±.015 [7.92±.381]	s mdo 01	.078 ± .015 [1.98 ± .381]	.020 [.508]
	RS-1A	.422 ± .015 [10.72 ± .381]	:bsolievi	.110±.015 [2.79±.381]	.020 [.508]
	RS-2	.625 ± .062 [15.88 ± 1.57]	.765 [19.43]	.250 ± .031 [6.35 ± .787]	.040 [1.02]
ETT.	RS-2B	.560 ± .062 [14.22 ± 1.57]	.622 [15.80]	.187 ± .031 [4.75 ± .787]	.032 [.813]
	RS-2C	.500 ± .062 [12.70 ± 1.57]	.593 [15.06]	.218 ± .031 [5.54 ± .787]	.040 [1.02]
	RS-2C-17	.500 ± .062 [12.70 ± 1.57]	.593 [15.06]	.218 ± .031 [5.54 ± .787]	.032 [.813]
	RS-2C-23	.500 ± .062 [12.70 ± 1.57]	.593 [15.06]	.218 ± .031 [5.54 ± .787]	.032 [.813]
TED	RS-5	.875 ± .062 [22.23 ± 1.57]	1.0 [25.4]	.312±.031 [7.92±.787]	.040 [1.02]
COATED	RS-5-69	.875 ± .062 [22.23 ± 1.57]	.937 [23.80]	.312±.031 [7.92±.787]	.040 [1.02]
39	RS-5-70	.875 ± .062 [22.23 ± 1.57]	1.0 [25.4]	.312 ± .031 [7.92 ± .787]	.040 [1.02]
	RS-7	1.22 ± .062 [30.94 ± 1.57]	1.28 [32.54]	.312±.031 [7.92±.787]	.040 [1.02]
201	RS-10	1.78 ± .062 [45.21 ± 1.57]	1.87 [47.50]	.375 ± .031 [9.53 ± .787]	.040 [1.02]
	RS-10-38	1.78 ± .062 [45.21 ± 1.57]	1.84 [46.79]	.375 ± .031 [9.53 ± .787]	.040 [1.02]
	RS-10-39	1.78 ± .062 [45.21 ± 1.57]	1.87 [47.50]	.375 ± .031 [9.53 ± .787]	.040 [1.02]

* NOTE: RS-1/8 terminal length will be 1.0" [25.4] minimum.

DERATING

Dale RS coated resistors have an operating temperature range of - 55°C to + 350°C . Dale RS molded resistors have an operating temperature range of - 55°C to + 275°C . They must be derated at high ambient temperatures according to the curves below.



CHARACTERISTIC U:

Coated or molded resistors are available in any tolerance.

CHARACTERISTIC V:

Coated resistors are available in 3% and 5% tolerance.

ENVIRONMENTAL PERFOR	MANCE *
TEST	DALE MAXIMUM
Temperature Coefficient	\pm 90PPM/°C, below 1 Ω \pm 50PPM/°C, 1 Ω -9.9 Ω \pm 20PPM/°C, 10 Ω and above
Thermal Shock	\pm (.2% + .05Ω) ΔR
Short Time Overload	\pm (.2% + .05Ω) ΔR
Dielectric	\pm (.1% + .05Ω) ΔR
Low Temperature Storage	± (.2% + .05Ω) ΔR
High Temperature Exposure	\pm (.5% + .05Ω) ΔR
Moisture Resistance	\pm (.2% + .05Ω) ΔR
Shock	\pm (.1% + .05Ω) ΔR
Vibration	\pm (.1% + .05Ω) ΔR
Load Life	± (.5% + .05Ω) ΔR
Terminal Strength	± (.1% + .05Ω) ΔR

APPLICABLE MIL SPECIFICATIONS

MIL-R-26E: Designed especially for precision and non-precision power wirewound resistors. The RS series meet the requirements of this specification as well as the older MIL-R-26C and MIL-R-23379 specifications. However, this does not imply qualification. Contact factory for latest Government QPL information.

SPECIAL MODIFICATIONS

- Terminals can be supplied in any commercial material with several type finishes.
- 2. Terminal lengths and diameters can be varied.
- 3. Various elements available for special T.C.
- 4. Special configuration available on request.
- 5. Tolerances available to .01% on most models.
- 6. Special matching available (T.C. and tolerance).

NS - NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding.

They are identified by substituting the letter N for R in the part number (NS-5, for example). Four conditions apply:

- 1. For NS models, divide maximum resistance values by two.
- 2. For NS models, multiply maximum working voltage by .707.
- 3. For NS models, maximum weights may slightly exceed those shown on low values.
- 4. Body O.D. on NS-2C may exceed that of the RS-2C by .010" [.254].

NS-1/8 NS-1/2 NS-2 NS-2C NS-7 NS-1/4 NS-1A NS-2B NS-5 NS-10

POWER RATING

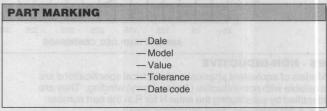
Dale RS models have two power ratings, depending on operating temperature and stability requirements.

CHARACTERISTIC U

- 1. 275°C maximum hotspot temperature.
- 2. .5% maximum ΔR in 2000 hour load life.

CHARACTERISTIC V

- 1. 350°C maximum hotspot temperature.
- 2. 3% maximum ΔR in 2000 hour load life.

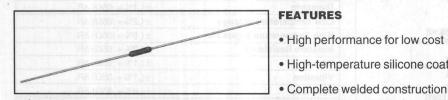


HOW	TO ORDER		的股份 。	
	RS-1A	10	1%	
	MODEL	RESISTANCE	TOLERANCE	

MODEL RS Wirewound Resistors

Miniature, Precision Power, Coated





FEATURES

- High performance for low cost
- High-temperature silicone coating
 - Excellent stability in operation

High power/size ratio

.34

.30

.65

D

.020

[.508]

020

[.508]

[.508]

.020

[.508]

.032

[.813]

NS-1/4-90

NS-1/2-90

NS-1A-90

NS-1M

NS-2M

Available in non-inductive styles (NS)

STANDARD ELECTRICAL SPECIFICATIONS RESISTANCE RANGE (Ohms) MAXIMIIM MAXIMUM POWER .5%, 1% WORKING WEIGHT MODEL RATING .05% .1% .25% 3%.5% **VOLTAGE** (Grams) .4 W .1-3.4k 20 .21 RS-1/4-90 1-1k .499-1k .499-3.4k RS-1/2-90 .75 W 1-1.3k .499-1.3k .499-4.9k .1-4.9k 29 23

.499-10.4k

499-6.85k

.1-18.74k

MAX.

B (Max.)

265

[6.73]

327

[8.30]

.437

[11.10]

.311

[7.90]

.562

.1-10.4k

.1-6.85k

1-18.74k

D + .002[.051]

C

078 + .015

 $[1.98 \pm .381]$

078 + 015

[1.98 ± .381]

.110 ± .015

 $[2.79 \pm .381]$

.110 ± .015

 $[2.79 \pm .381]$

 $.185 \pm .015$

C

52

41

95

* Maximum working voltage determined at .0008" diameter wire resistance value

499-2.74k

.499-1.67k

.499-4.49k

1-2.74k

1-1.67k

.499-4.49k

_ 1.50 [38.10]

A

.250 ± .015

[6.35 ± .381]

312 + 015

[7.92 ± .381]

422 ± .015

.295 ± .015

 $[7.50 \pm .381]$

 $.500 \pm .062$

[10.72 ± .381]

DIMENSIONAL CONFIGURATIONS

RS-1A-90

RS-1M

MODEL

RS-1/4-90

BS-1/2-90

RS-1A-90

RS-1M

RS-2M

1.0 W

1.0 W

30W

(Numbers in brackets indicate millimeters)

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: $\pm 5\%$, $\pm 3\%$, $\pm 1\%$,

 $\pm .5\%$, $\pm .25\%$, $\pm .1\%$, $\pm .05\%$.

Temperature Coefficient: (-55°C to +275°C).

±90PPM/°C below 1 ohm.

±50PPM/°C 1.0 ohm - 9.9 ohm.

±20PPM/°C 10 ohm and above.

Short Time Overload: 5 seconds at 5 times

rated power.

Dielectric Strength: 1000 VAC minimum for RS-2M. 500 VAC minimum for all other styles.

Insulation Resistance: 1000 Megohm minimum dry. 100 Megohm minimum after moisture test.

MATERIAL SPECIFICATIONS

Core Ceramic: Alumina.

Element: Copper-nickel alloy or nickel-chrome

alloy, depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone. Standard Terminals: Tinned Copperweld®.

MECHANICAL SPECIFICATIONS

Terminal Strength: 10 pound pull test = RS-2M.

5 pound pull test = all other styles.

Solderability: 60/40 electro tin plated terminals

to facilitate soldering.

	[12.70	0 ± 1.57]		[14.2	27]	[4.70	±.381]	GR.
DERATING								
% OF RATED POWER	120 100 80 60 40 20 0						0.4 R.4	
	25	75 A	125 AMBIEN	175 T TEMP.	225 DEG. CE	275 NTIGRAI	325 DE	375

NS - NON-INDUCTIVE

Models of equivalent physical and electrical specifications are available with non-inductive (Aryton-Perry) winding. They are identified by substituting the letter N for R in the part number (NS-5, for example). Four conditions apply:

- For NS models, divide maximum resistance values by two. 2. For NS models, multiply maximum working voltage by .707.
- 3. For NS models, maximum weights may slightly exceed those shown on low values
- 4. Body O.D. on NS-2M may exceed that of the RS-2M by .015" [.381].

ENVIRONMENTAL PER	RFORMANCE *
TEST	DALE® MAXIMUM
Temperature Coefficient	±90 PPM/°C below 1 Ω ±50 PPM/°C 1.0 Ω - 9.9 Ω ±20 PPM/°C 10 Ω and above
Thermal Shock	$\pm (.2\% + .05\Omega) \Delta R$
Short Time Overload	\pm (.2% + .05Ω) ΔR
Dielectric	\pm (.1% + .05Ω) ΔR
Low Temperature Storage	\pm (.2% + .05Ω) ΔR
High Temperature Exposure	$\pm (.5\% + .05\Omega) \Delta R$
Moisture Resistance	\pm (.2% + .05Ω) ΔR
Shock	\pm (.1% + .05Ω) ΔR
Vibration	$\pm (.1\% + .05\Omega) \Delta R$
Load Life	\pm (.5% + .05Ω) ΔR
Terminal Strength	$\pm (.1\% + .05\Omega) \Delta R$

All ΔR figures shown are maximum based on units with an initial tolerance of 1% and maximum operating temperature of 275°C.

POWER RATING

- 275°C maximum hotspot temperature.
- .5% maximum ΔR in 2000 hour load life.

NOTE: For Part Marking and How To Order Information see the RS Precision Power, MIL-R-26, data sheet. In the How To Order Information, substitute RS-1M for Model.

MODEL	RATING	.05%	.1%	.25%	3%, 5%	VOLTAGE*
WSC-1/2	1/2 W	0.5-527	.30-527	.20-1.41k	0.1-1.41k	22.9 V
WSC-1	1 W	0.62-1k	0.43-1k	0.43-2.77k	0.1-2.77k	28.2 V
WSC-2	2 W	1.0-2.74k	.499-2.74k	.499-10.4k	.005-10.4k	52.4 V

* Maximum working voltage determined @ .0008 diameter resistance value.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Nickel silver alloy.

Molding: Special high temperature encapsulation.

Standard Terminals: Tinned copper alloy.

remperature Coemicient:

- ± 90PPM/°C, 0.1 ohm-0.99 ohm.
- ± 50PPM/°C, 1.0 ohm-9.9 ohm.
- ± 20PPM/°C, 10 ohm and above.

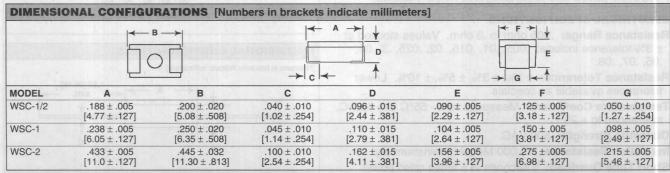
(Below 0.1 ohm, consult factory). Dielectric Strength: 500 VAC.

Insulation Resistance: 1000 Megohm minimum dry, 100 Megohm after moisture test.

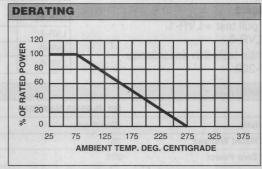
Short Time Overload: 5 seconds at 5 times rated

power. **Solderability:** 60/40 electro tin plated terminals

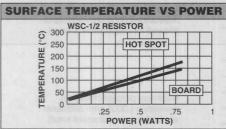
to facilitate soldering.

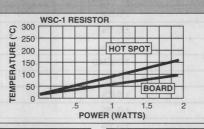


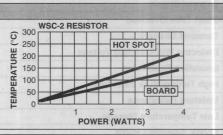
ENVIRONMENTAL PE	RFORMANCE
TEST	DALE MAXIMUM
Temperature Coefficient	20 to 90 PPM/°C
Thermal Shock	\pm (.2% + .05Ω) ΔR
Short Time Overload	\pm (.2% + .05 Ω) Δ R
Dielectric	\pm (.1% + .05Ω) ΔR
Low Temp. Storage	\pm (.2% + .05Ω) ΔR
High Temp. Exposure	\pm (.5% + .05Ω) ΔR
Moisture Resistance	\pm (.2% + .05Ω) ΔR
Shock	\pm (.1% + .05 Ω) Δ R
Vibration	\pm (.1% + .05 Ω) Δ R
Load Life	\pm (.5% + .05 Ω) Δ R
NOTE: Environmental specification	ns referenced @ 25°C.











PACKAGING

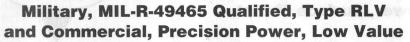
Embossed Carrier Tape per EIA-481-1, 2.

Tape Widths: WSC-1/2 = 12mm/2000 pieces/13" reel. WSC-1 = 16mm/2000 pieces/13" reel. WSC-2 = 24mm/1200 pieces/13" reel.

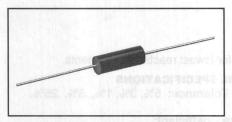
 WSC-1
 10
 1%

 MODEL
 RESISTANCE
 TOLERANCE

MODELS LVR-1, LVR-3, LVR-5 Wirewound Resistors







FEATURES

- Ideal for all types of current sensing applications including switching and . Low temperature coefficient linear power supplies, instruments and power amplifiers
- Proprietary processing technique produces extremely low resistance
- · Excellent load life stability
- 275°C maximum operating temperature
- Low inductance
- MIL-R-49465 styles available
- Cooler operation for high power to size

STAND	ARD ELECT	TRICAL	SPECIFICATIONS	
DALE MODEL	MIL-R-49465 TYPE	POWER RATING (Watts)	RESISTANCE RANGE* (Ohms) MIL Range shown in bold face	MAXIMUM WEIGHT (Grams)
LVR-1	rigin—majo	1 W	.011	2
LVR-3	RLV30	3 W 3 W	. 012 .0052	2
LVR-5	RLV31	5 W 5 W	. 013 .0053	2

Resistance must be measured 3/8" [9.52] from the body of resistor. or at a 1.315" [33.40] or 1.675" [42.545] spacing for the LVR-3 or -5 respectively.

ELECTRICAL SPECIFICATIONS

Resistance Range: .005 ohm to .3 ohm. Values stocked at ± 3% tolerance include: .005, .01, .015, .02, .025, .3, .04, .05, .07, .08.

Resistance Tolerance: \pm 1%, \pm 3%, \pm 5%, \pm 10%. Lower tolerances available as specials.

Temperature Coefficient: Measured from - 55°C to + 125°C, referenced to + 25°C.

Dielectric Strength: 500 VAC.

Insulation Resistance: 10,000 Megohm minimum dry. Short Time Overload: 5 seconds at 5 times rated power.

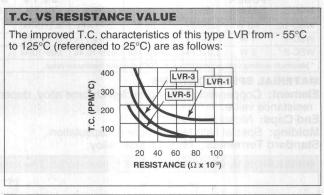
MECHANICAL SPECIFICATIONS

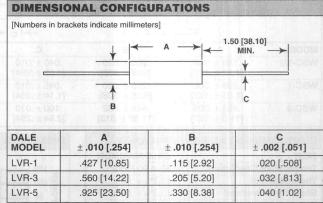
Terminal Strength: 5 pound pull test = LVR-1.

10 pound pull test = LVR-3, LVR-5.

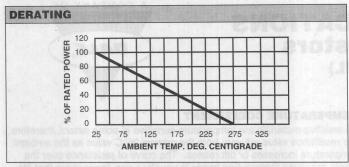
Solderability: Satisfactory when tested in accordance

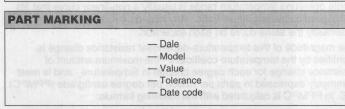
with Method 208 of MIL-STD-202.

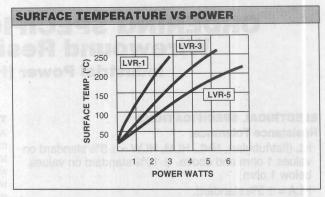


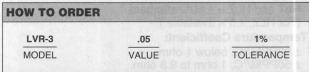


ENVIRONMENTAL PERFORMANCE			
TEST	MIL-R-49465 MAXIMUM	UNITS	
Resistance-Temperature Characteristic	(See chart)	Parts/Million/°C	
Maximum Ambient Temperature at Rated Wattage	25	- Degrees Celsius	
Maximum Ambient Temperature at Zero Power	275	- Degrees Ceisius	
Thermal Shock	± 0.2%	Maximum percent change in	
Short Time Overload	± 0.5%	resistance (.0005 ohm additional allowed for measurement error).	
Terminal Strength	± 0.1%		
Dielectric Withstanding Voltage	± 0.1%		
Insulation Resistance	1.000ΜΩ		
High Temperature Exposure	± 1.0%		
Moisture Resistance	± 0.2%	Maximum percent change in	
Low Temperature Storage	± 0.2%	resistance (.0005 ohm additional allowed for measurement error).	
Shock, Specified Pulse	± 0.1%		
Vibration, High Frequency	± 0.1%		
Life	± 1.0%	THE REPORT OF THE PARTY OF THE	
Tolerance	1%, 3%, 5%	Percent	





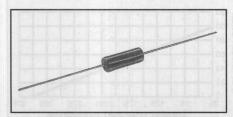




MODEL LVR-10 Wirewound Resistors

Military, MIL-R-49465 Qualified, Type RLV32 and Commercial, Precision Power, Low Value





FEATURES

- Extremely low resistance values
- High power rating
- · Low temperature coefficient
- 275°C maximum operating temperature
- MIL-R-49465 style available, LVR-10-26

ELECTRICAL SPECIFICATIONS

Resistance Range: .01 ohm to .8 ohm, Commercial. .01 ohm to .5 ohm, Military. Resistance must be measured 3/8" [9.52] from body of resistor.

Resistance Tolerance: \pm 1%, \pm 3%, \pm 5%, \pm 10%. Lower

tolerances available as specials.

Power Rating: 10 watt.

Dielectric Strength: 500 VAC.

Insulation Resistance: 10,000 Megohm minimum dry.
Short-Time Overload: 5 seconds at 10 times rated power.
Temperature Coefficient: Varies with resistance values.

Consult factory.

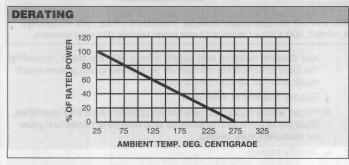
MECHANICAL SPECIFICATIONS

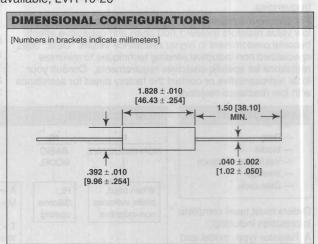
Terminal Strength: 10 pound pull test.

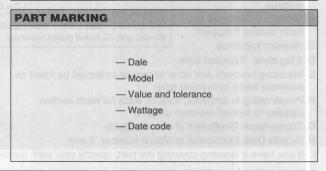
Solderability: Satisfactory when tested in accordance

with Method 208 of MIL-STD-202.

Maximum Weight: 11.0 grams.







ORDERING SPECIFICATIONS **Wirewound Resistors**

Industrial Power (HL)



ELECTRICAL SPECIFICATIONS

Resistance Tolerance:

HL (flat/tubular), NHL, HLM, HLW = \pm 5% standard on values 1 ohm and above. ± 10% standard on values below 1 ohm.

 $HLA = \pm 5\%$ standard.

HLT and HLZ = \pm 10% standard. (For HLZ, ± 5% available.)

Temperature Coefficient:

- ± 90PPM/°C, below 1 ohm.
- \pm 50PPM/°C, 1 ohm to 9.9 ohm. \pm 30PPM/°C, 10 ohm and above.

Dielectric Strength: 1000 VAC minimum.

Short Time Overload: In intermittent duty the applied power can greatly exceed the wattage rating. However, since each pulse application is somewhat unique, the factory should be contacted for specific requirements.

MATERIAL SPECIFICATIONS

Core: Steatite. Chemically inert - will withstand severe thermal shock and is impervious to moisture.

Element: Highest quality copper-nickel alloy or nickelchrome alloy, depending on resistance value. Special alloys available upon request.

Coating: HL - special high temperature silicone, cured at much lower temperatures than vitreous enamels.

REACTANCE

All resistors have capacitance and inductance as well as pure resistance, and these factors can become significant at high

For wirewound resistors, inductive effects are predominant in low value resistors (below 1,000 ohm) and capacitive effects become predominant in higher resistance values. Dale® uses specialized non-inductive winding techniques to minimize reactance for specific customer requirements. Consult your local representative or contact the factory direct for assistance with low reactance resistors.

TEMPERATURE COEFFICIENT

All resistive materials are temperature sensitive to some extent, therefore, the resistance value will vary from the original 25°C value as the ambient temperature increases or decreases. The curve of resistance over the whole operating temperature range is usually a non-linear curve that fits within predictable maximum limits. Any individual resistor will trace essentially the same curve on each excursion.

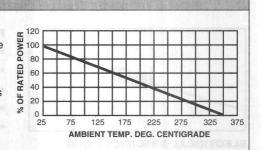
The magnitude of this temperature-dependent resistance change is identified by the temperature coefficient - the maximum amount of resistance change for each degree change in temperature - and is most commonly expressed in parts per million per degree centigrade (PPM/°C). T.C. in PPM/°C is calculated with the following formula:

T.C. =
$$\begin{array}{ccc} R_1 = \text{resistance at } T_1 \\ \hline R_2 - R_1 \\ \hline (T_2 - T_1) R_1 \end{array} & R_2 = \text{resistance at } T_2 \\ \hline T_1 = \text{reference temperature (°C)} \\ T_2 = \text{test temperature} \end{array}$$

T.C. as low as ± 20PPM/°C or as high as + 5500PPM/°C can be obtained on many values. Contact the Dale factory for your special T.C. needs.

DERATING

Industrial wirewound resistors have an operating temperature range of - 55°C to + 350°C. They must be derated at high ambient temperatures according to the curve at the right.



POWER RATING

Power rating is based on:

- 1. 325°C heat rise for HL Models.
- 2. 375°C heat rise for HLZ Models.
- 3. 3% maximum ΔR in 2000 hour load life test.

PART MARKING - Dale - Model - Value and tolerance - Wattage Date code

Orders must have complete information including:

- A. Resistor type, model and wattage.
- B. Resistor value (total and each section if tapped).
- C. Resistor tolerance.
- D. If lug style: Terminal style.
- E. Mounting brackets and other accessories should be listed as separate items by bracket type.
- F. Power rating in amperes, volts or watts for each section (applies to tapped resistors only).
- G. Temperature Coefficient (if non-standard).
- H. Include Dale Electronics quotation number, if any.
- I. If you have a drawing covering the part, specify your part number

HOW TO ORDER HL ± 5% NON-INDUCTIVE BASIC STYLE SIZE TERMINAL TERMINAL FINISH VALUE TOLERANCE MODEL When used. HI: A = Adjustable N = Nickel Plated prefix indicates Silicone M = Miniature Z = Tinned non-inductive coating flat style W = Bare Alloy T = Tapped180 lead on W = Wire leads **HLW** models Z = Edgewound **EXAMPLES:**

NHL-50-06N, $100\Omega \pm 5\%$ = Non-inductive 50 watt unit, 06 nickel plated terminals. HLA-20-02N, $50\Omega \pm 5\%$ = Adjustable 20 watt unit, 02 nickel plated terminals. HL-12-05Z, $50\Omega \pm 5\% = Standard$ 12 watt power resistor, 05 tinned terminals.

- and drawing number, and supply a copy with the order. Including the Dale specification number on your drawing will assure exact duplication on all your future orders.
- J. Specify quantity of each item.
- K. Prices will be quoted on request on specific items and quantities. Quantity of each item ordered at one time determines unit price for manufacturers' orders.
- L. Specify routing.

MODELS HL and NHLWirewound Resistors

Industrial Power, Tubular (HL), Non-Inductive Tubular (NHL)





APPLICATIONS - HL

Special applications include grid resistors, voltage dropping resistors, high voltage bleeder resistors in power supplies, bias supply resistors, voltage divider networks, filament dropping resistors, load resistors, shunt resistors.

Dale[®] HL resistors for inexpensively dissipating larger amounts of power in DC or low frequency AC circuits.

APPLICATIONS - NHL

Dummy antennas, terminating resistors, any resistance function where low effective inductance is needed.

Dale NHL resistors utilize Aryton-Perry winding (two single-layer parallel windings in opposite directions) to cancel most of the inductive effects.

STANDAR	D ELECTRICA	L SPECIFICATION	NS
MODEL	WATTAGE RATING	MAXIMUM * RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE
HL-12	12	50k	500
NHL-12		3.9k	166
HL-20	20	120k	880
NHL-20		6.8k	316
HL-25	25	155k	1.3k
NHL-25		8.8k	432
HL-50	50	136k	1.9k
NHL-50		21.5k	866
HL-100	100	306k	2.5k
NHL-100		48.5k	1.9k
HL-175	175	606k	5.2k
NHL-175		112k	3.7k
HL-225	225	760k	6.1k
NHL-225		121k	4.5k

Minimum resistance is .1 ohm for HL, 1 ohm for NHL.
 tolerance is standard on values 1 ohm and above,
 on values below 1 ohm. Lower tolerances available.

TYPICAL INDUCTANCE				
RESISTANCE (Ohms)	DALE STANDARD WINDING	DALE NON-INDUCTIVE WINDING		
90	HL-12 = 9.5 microhenrys	NHL-12 = 0.2 microhenry		
300	HL-25 = 50 microhenrys	NHL-25 = 0.25 microhenry		
1k	HL-100 = 310 microhenrys	NHL-100 = 0.7 picofarads		

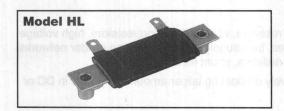
NOTE: NHL resistors utilize the same cores, terminals and mounting hardware as HL models. However, resistance values are lower because of spacing allowances which must be made in the Aryton-Perry winding.

			COR	E DIMENSIO	NS			
ANT AND DESIGNATION	MODEL	A MAX.	LENGTH ± 1/16 [1.59]	O.D.	I.D. ± 1/32 [.794]	TERMINAL SETBACK ± 1/32 [.794]	STANDARD* TERMINAL DESIGNATION	MOUNTING HARDWARE OPTIONS
具	HL-12 NHL-12	13/32 [10.32]	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	3/32 [2.38]	05	101, 204, 301
	HL-20 NHL-20	9/16 [14.29]	2 [50.80]	7/16 [11.11]	5/16 [7.94]	3/32 [2.38]	02	101, 203, 301
	HL-25 NHL-25	11/16 [17.46]	2 [50.80]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	101, 203, 301
A ->	HL-50 NHL-50	11/16 [17.46]	4 [101.60]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	101, 203, 301
(Includes coating	HL-100 NHL-100	29/32 [23.02]	6-1/2 [165.10]	3/4 [19.05]	1/2 [12.70]	1/8 [3.18]	06	102, 206, 303
and terminal band)	HL-175 NHL-175	1-5/16 [33.34]	8-1/2 [215.90]	1-1/8 [28.58]	3/4 [19.05]	7/32 [5.56] —	07	103, 205, 303
	HL-225 NHL-225	1-5/16 [33.34]	10-1/2 [266.70]	1-1/8 [28.58]	3/4 [19.05]	7.32 [5.56]	07	103, 205, 303

MODELS HL and HLM Wirewound Resistors

Industrial Power, Flat (HL), Miniature Flat (HLM)





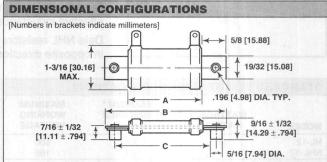
FEATURES

- High power-to-size ratio
- Mounting accommodations ideally suited to high density packaging
- Self-stacking hardware for horizontal or vertical placement
- · Withstands high vibration without loosening
- Mountings function as heat sinks allowing greater heat dissipation and less derating of stacked units

STANDA	RD ELECTRICA	L SPECIFICATIO	NS
MODEL	WATTAGE RATING	MAXIMUM* RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE
HL-24	30	11k	575
HL-35	40	27k	1040
HL-55	55	61k	1.8KV
HL-95	95	111k	2.6KV

Minimum resistance is .1 ohm for all models.
 tolerance is standard on values 1 ohm and above, 10% on values below 1 ohm.
 Lower tolerances available.

DERATING STACK MOUNTED UNITS					
NO. OF	PERC	ENT OF SINGLE UNIT	RATING		
RESISTORS IN STACK	MINIATURE	WITH 1/4" [6.35] SPACER	STANDARI		
2 5/18/8)	72	mea ent 80	70		
3	61	73	60		
4	51	64	50		



100	A ± 1/16	B ± 1/16	C ± 1/32	TERMINAL SETBACK	STANDARD* TERMINAL
MODEL	[1.59]	[1.59]	[.794]	± 1/32 [.794]	DESIGNATION
HL-24	1-1/4 [31.75]	2-1/2 [63.50]	2 [50.80]	5/64 [1.98]	09
HL-35	2 [50.80]	3-1/4 [82.55]	2-3/4 [69.85]	5/64 [1.98]	09
HL-55	3-1/2 [88.90]	4-3/4 [120.65]	4-1/4 [107.95]	5/64 [1.98]	09
HL-95	6 [152.40]	7-1/4 [184.15]	6-3/4 [171.45]	5/64 [1.98]	09

* Contact factory for optional, non-standard terminals, including quick disconnect types. See page 69 for dimensions.



STANDAR	RD ELECTRICAL	SPECIFICATION	VS
MODEL	WATTAGE* RATING	MAXIMUM** RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE
HLM-10	07 - 10 00	15k	300
HLM-20	20	65k	1000

- * Mounted horizontally on 10" x 10" x .04" [250.40 x 250.40 x 1.02] steel plate.
- ** Minimum resistance .1 ohm for all models.

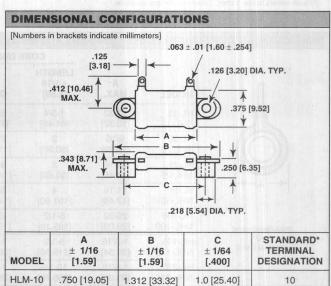
 5% tolerance is standard on values 1 ohm and above, 10% on values below 1 ohm.

 Lower tolerances available.

EXCLUSIVE BRACKET DESIGN *

Mounting strap fits snugly through core and is bound tightly against unit by two eccentric spacers. Eliminates expensive cements and improves heat transfer and power handling capabilities.

* Patent 3390367



2.625 [66.68]

2.313 [58.75]

10

HLM-20

2.062 [52.37]

Contact factory for optional, non-standard terminals See page 69 for dimensions.

MODELS HLW and HLZ Wirewound Resistors

Industrial Power, Tubular (HLW), Edgewound (HLZ)





STANDARD ELECTRICAL SPECIFICATIONS				
MODEL	WATTAGE RATING	MAXIMUM* RESISTANCE (Ohms)		
HLW-3	3	6k		
HLW-5	5-1/4	15k		
HLW-6	8	25k		
HLW-12	12	70k		
HLW-20	20	120k		

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 5% tolerance standard 1 ohm and above. 10% below 1 ohm. Lower tolerances available.

MATERIAL SPECIFICATIONS

Construction: Identical to Model HL, but with lug-attached leads to facilitate direct electrical connection by soldering.

	Three and five watt core ength less 5/32 [3.97]. All other types, core ength less 5/16 [7.94].		Three and five watt t	ypes 3/64 [1.19]. types 3/32 [2.38]. — 18 AWG 20 AWG for three a five watt types.	HLW-3, HLW-5 [1.59 ± 7.794]. / 1/8 ± 1/32 [3	All other types	2/2 ± 1/8 2 3.18] TYP.
CORE DIM		RE DIMENSION	IS		AXIAL**	RADIAL**	1
MODEL	LENGTH ± 1/16 [1.59]	O.D.	I.D. ± 1/32 [.794]	A (Max.)	TERMINAL DESIGNATION	TERMINAL DESIGNATION	MOUNTING HARDWARE
HLW-3	7/16 [11.11]	13/64 [5.16]	1/8 [3.18]	19/64 [7.54]	A2	R2	-
HLW-5	5/8 [15.88]	1/4 [6.35]	1/8 [3.18]	11/32 [8.73]	A2	R2	人。
HLW-6	1 [25.40]	5/16 [7.94]	3/16 [4.76]	13/32 [10.32]	08 Cal S A1	R1	101, 204, 301
HLW-12	1-3/4 [44.55]	5/16 [7.94]	3/16 [4.76]	13.32 [10.32]	A1	R1	101, 204, 301
HLW-20	2 [50.80]	7/16 [11.11]	5/16 [7.94]	9.16 [14.29]	A1 A1	Bar ave R1	102, 203, 301



FEATURES

- Designed to meet heavy-duty requirements where space is at a premium
- High thermal capacity for intermittent or short duration
- Silicone coating allows maximum heat transfer from wire surface

[83.8] 141,	WATTAGE	RESISTANCE RANG		
MODEL	RATING	(Min.) (Max		
HLZ-33	35	.05	1.9	
HLZ-90	90	.15	5.7	
HLZ-165	165	.36	13.0	
HLZ-300	300	.23	25.0	

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 10% standard.

±5% available.

Dielectric Strength: 1000 V from terminals to

mounting hardware.

Temperature Rise: 375°C at full power. Slightly higher temperatures will occur in maximum resistance units.

MODEL	CORE DIMENSIONS			STANDARD*		
	LENGTH ± 1/16 [1.59]	O.D.	I.D. ± 1/32 [.794]	TERMINAL DESIGNATION	MOUNTING HARDWARE	
HLZ-33	2 [50.8]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301	
HLZ-90	4 [101.6]	9/16 [14.29]	5/16 [7.94]	06	101, 203, 301	
HLZ-165	6-1/2 [165.1]	3/4 [19.05]	1/2 [12.70]	06	102, 206, 303	
HLZ-300	8-1/2 [215.9]	1-1/8 [28.58]	3/4 [19.05]	07	103, 205, 303	
[Numbers in	brackets indicate	millimeters]				

MATERIAL SPECIFICATIONS

Construction: A ribbon element is edgewound onto a ceramic tube and is coated with silicone. Silicone coating holds ribbon wire firmly against core while allowing maximum exposure of wire surface for heat transfer by radiation and convection.

MODELS HLA and HLT Wirewound Resistors

Industrial Power, Adjustable (HLA), Tapped (HLT)





FEATURES

- · Adjustable resistor or voltage divider
- · Can be used to quickly obtain odd resistance values
- · Can be used as multi-tap resistor
- One or more adjustable lugs can be provided for voltage-divider applications

MODEL	WATTAGE RATING	MAXIMUM * RESISTANCE (Ohms)	MAXIMUM WORKING VOLTAGE
HLA-12	12	10k	350
HLA-20	20	18k	600
HLA-25	25	25k	790
HLA-50	50	100k	1.9K
HLA-100	100	100k	2.5K
HLA-175	175	100k	4.1K
HLA-225	225	100k	4.75K

ELECTRICAL SPECIFICATIONS

Tolerance: The standard tolerance on the total resistance is \pm 5% and is checked with the adjustable terminal removed from the unit, in accordance with MIL-R-19365C.

Wattage Rating: To avoid overloading any section of an adjustable resistor, do not exceed the maximum rated current based on total resistance. The wattage ratings shown on the chart apply only when the entire resistance is in the circuit. The adjustable lug divides the wattage rating in proportion to the divided resistance.

	OCEANORS O	CONTRACTOR AND A	COF	RE DIMENSION	NS	TERMINAL	STANDARD*	ATTE L	
	MODEL	A (Max.)	LENGTH ± 1/16 [1.59]	O.D.	I.D. ± 1/32 [.794]	SETBACK ± 1/32 [.794]	TERMINAL DESIGNATION	ADJ. SLIDER	MOUNTING HARDWARE
Ö	HLA-12	13/32 [10.32]	1-3/4 [44.45]	5/16 [7.94]	3/16 [4.76]	3/32 [2.38]	05	70	101, 204, 301
	HLA-20	9/16 [14.29]	2 [50.80]	7/16 [11.11]	5/16 [7.94]	3/32 [2.38]	02	71	101, 203, 301
	HLA-25	11/16 [17.46]	2 [50.80]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	72	101, 203, 301
	HLA-50	11/16 [17.46]	4 [101.60]	9/16 [14.29]	5/16 [7.94]	3/32 [2.38]	06	72	101, 203, 301
	HLA-100	29/32 [23.02]	6-1/2 [165.10]	3/4 [19.05]	1/2 [12.70]	1/8 [3.18]	06	73	102, 206, 303
← A →	HLA-175	1-5/16 [33.34]	8-1/2 [215.90]	1-1/8 [28.58]	3/4 [19.05]	7/32 [5.56]	07,	74	103, 205, 303
ncludes coating ad terminal band)	HLA-225	1-5/16 [33.34]	10-1/2 [266.70]	1-1/8 [28.58]	3/4 [19.05]	7/32 [5.56]	07	74	103, 205, 303

ADJUSTABLE RESISTOR INFORMATION

Moving Adjustable Lugs: The coatings protect the resistance wire from shifting and shorting to other turns during adjustment. However, the following three steps should always be taken whenever adjustments are made: (1) Turn off current to avoid possible operator injury and damage to the unit. (2) Loosen adjustable lug until it will slide completely free, without touching the exposed wire. (3) When adjustment point has been selected, retighten lug only enough to assure a firm contact, do not tighten beyond this point. Failure to follow these three steps in order can result in damage to the resistor.

WIDTH → _ ←	MODEL NUMBER	WIDTH	HEIGHT	HOLE DIAMETER
HOLE HEIGHT	70	3/16 [4.76]	33/64 [13.10]	.125 [3.18]
Ø <u>+</u>	71	1/4 [6.35]	19/32 [15.08]	.156 [3.96]
	72	1/4 [6.35]	23/32 [18.26]	.141 [3.58]
	73	1/4 [6.35]	25/32 [19.84]	.141 [3.58]
ISCORT LEM	74	5/16 [7.94]	25/32 [19.84]	.170 [4.32]



FEATURES

Provides fixed taps for voltage dividers

ELECTRICAL SPECIFICATIONS

Tolerance: The standard tolerance is \pm 10% for the total resistance. Closer tolerance can be supplied upon request.

Power Rating & Maximum Resistance: The winding space is slightly reduced by the additional terminals, resulting in a small reduction of power rating and maximum resistance. Consult the factory for information on specific applications. To insure proper resistor design, the power rating for each section must be specified.

Available as a modification of HL Tubular, HL Flat or HL Miniature Flat models.

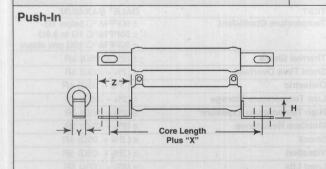
SPECIFICATIONSWirewound Resistors

Industrial Power (HL)

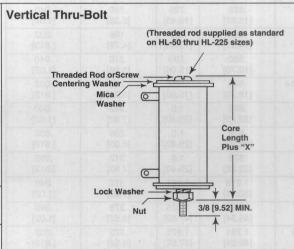


TERMINAL DIMENSIONAL CONFIGURATIONS	[Numbers in b	rackets	indicat	e millim	eters]	75835		11777	
Terminals for HL, HLM and HLW Thickness Thickness	TERMINAL DESIGNATION	02	05	06	07	09	10	A1, R1	A2, R2
Width → ← → ← Width → ← → ← Hole DIA. → ○ ↓ ■	WIDTH	3/16 [4.76]	3/16 [4.76]	1/4 [6.35]	3/8 [9.52]	3/16 [4.76]	1/8 [3.18]	1-1/2 [38.10] 18 AWG	1-1/2 [38.10] 20 AWG
STYLE 02 Height STYLE 10 Height	HEIGHT	13/32 [10.32]	7/16 [11.11]	9.16 [14.29]	5/8 [15.88]	1/2 [12.70]	3/16 [4.76]	Lead	Lead
All terminals will be supplied in tinned finish (Z) unless	HOLE DIA.	.093 [2.36]	.104 [2.64]	.166 [4.22]	.173 [4.39]	.104 [2.64]	.063 [1.60]	3.0	C V-2C
otherwise specified. Optional finishes are nickel plated (N) for HL's, bare alloy 180 (W) for HLW lead styles. Specify proper suffix in part number designation when ordering.	THICKNESS	.020 [.508]	.020 [.508]	.020 [.508]	.020 [.508]	.020 [.508]	.030 [.762]		1-05-V D 118-V D

Horizontal Thru-Bolt	BRACKET TYPE	x	Y	Z	н	MOUNTING SLOT	С	В
(Threaded Rod Supplied as Standard on HL-50 thru HL-225 Sizes)	101	1-1/16 [26.99]	1/2 [12.70]	55/64 [21.83]	1 [25.40]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/8 [34.92
(O) a d B H B H	102	1-1/16 [26.99]	3/4 [19.05]	55/64 [21.83]	1-1/4 [31.75]	7/32 x 7/16 [5.56 x 11.11]	3/4 [19.05]	1-3/4 [44.45
	103	1-1/16 [26.99]	1-1/4 [31.75]	1 [25.40]	1-1/2 [38.10]	9/32 x 9/16 [7.14 x 14.29]	7/8 [22.22]	2-1/8 [53.98



BRACKET	CONTRACTOR OF THE PARTY.	pageof roqui	omam, basis	an assumed	a alrupit RollA
TYPE	х	н	Y	Z	HOLE
203	5/8	43/64	1/4	15/32	.161 DIA.
	[15.88]	[17.06]	[6.35]	[11.91]	[4.09]
204	3/8	9/32	1/4	11/32	.144 DIA.
	[9.52]	[7.14]	[6.35]	[8.73]	[3.66]
205	13/16	1-25/64	1/2	11/16	.196 x .260
	[20.64]	[35.32]	[12.70]	[17.46]	[4.98 x 6.60]
206	23/32	31/32	3/8	5/8	.196 x .375
	[18.26]	[24.61]	[9.52]	[15.88]	[4.98 x 9.52]



BRACKET TYPE	(Approximate)	THREAD
301	7/16 [11.11]	8-32
303	1/2 [12.7]	10-32

MODEL CW **Wirewound Resistors**

Coated





MODEL

CW-2

CW-2B*

CW-2C

CW-5**

CW-5-2

CW-2C-14

[Numbers in brackets indicate millimeters]

POWER RATING (Max. Hot Spot)

275°C 350°C

5.5

3.75

3.25

3.25

6.5

5.0

4.0

3.0

2.5

2.5

5.0

4.0

STANDARD ELECTRICAL SPECIFICATIONS

RESISTANCE

RANGE

(Ohms)

1-28.7k

.1-15k

1-19.9k

1-19.9k

1-58.5k

1-40.3k

FEATURES

MAX.

WT.

(Grams)

2.1

.70

1.6

1.6

4.2

4.2

- · High performance for low cost
- High-temperature silicone coating

275°C

200

125

130

130

320

240

MAXIMUM

WORKING VOLTAGE

350°C

235

140

150

150

365

265

- Complete welded construction
 High power/size ratio
- Excellent stability in operation

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 5% standard 1 ohm and above. \pm 10% standard below 1 ohm. \pm 2% and \pm 3% available.

Temperature Coefficient: (- 55°C to + 350°C).

- ± 90PPM/°C below 1 ohm.
- \pm 50PPM/°C 1 ohm to 9.9 ohm. \pm 30PPM/°C 10 ohm and above.

Short Time Overload: 5 seconds at 5 times rated power for 3.75 watt size and smaller. 5 seconds at 10 times rated power for 4 watt size and larger.

Dielectric Strength: 1000 VAC minimum.

MECHANICAL SPECIFICATIONS

Terminal Strength: 10 pound pull test.

Solderability: 60/40 electro tin plated terminals to

facilitate soldering.

MATERIAL SPECIFICATIONS

Core: Ceramic: Steatite or alumina, depending on physical size.

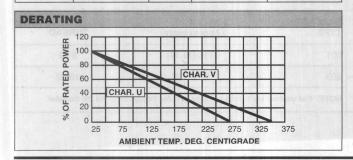
Element: Copper-nickel alloy or nickel-chrome alloy, depending on resistance value.

End Caps: Stainless steel.

Coating: Special high temperature silicone. Standard Terminals: Tinned Copperweld®.

CW-5-3	5.0	6.5	.1-58.5k	4.2	320	365
CW-7	7.0	9.0	.1-95.2k	4.7	460	520
CW-10	10.0	13.0	.1-167k	9.0	765	875
CW-10-3	10.0	13.0	.1-167k	9.0	765	875
DIMENS	IONAL	CONFI	GURATION	15	i de de los es	
	1.50	[38.10]				

MODEL	A	B	C	D
	± .062 [1.57]	(Max.)	± .032 [.813]	± .002 [.051]
CW-2	.625	.765	.250	.040
	[15.87]	[19.43]	[6.35]	[1.02]
CW-2B	.562	.622	.188	.032
	[14.27]	[15.80]	[4.78]	[.813]
CW-2C	.500	.593	.218	.040
	[12.70]	[15.06]	[5.54]	[1.02]
CW-2C-14	.500	.593	.218	.032
	[12.70]	[15.06]	[5.54]	[.813]
CW-5	.875	1.0	.312	.040
	[22.22]	[25.40]	[7.92]	[1.02]
CW-5-2	.875	1.0	.250	.032
	[22.22]	[25.40]	[6.35]	[.813]
CW-5-3	.875	1.0	.312	.032
	[22.22]	[25.40]	[7.92]	[.813]
CW-7	1.218	1.281	.312	.040
	[30.94]	[32.54]	[7.92]	[1.02]
CW-10	1.781	1.875	.375	.040
	[45.24]	[47.62]	[9.52]	[1.02]
CW-10-3	1.781	1.875	.375	.032
	[45.24]	[47.62]	[9.52]	[.813]



ENVIRONMENTAL PERFOR	MANCE *
TEST	DALE® MAXIMUM
Temperature Coefficient	\pm 90PPM/°C below 1Ω \pm 50PPM/°C 1Ω to 9.9Ω \pm 30PPM/°C 10Ω and above
Thermal Shock	\pm (2% + .05Ω) ΔR
Short Time Overload	± (2% + .05Ω) ΔR
Dielectric	\pm (.1% + .05Ω) ΔR
Low Temperature Storage	± (2% + .05Ω) ΔR
High Temperature Exposure	± (2% + .05Ω) ΔR
Moisture Resistance	± (2% + .05Ω) ΔR
Shock	\pm (.2% + .05Ω) ΔR
Vibration	\pm (.2% + .05Ω) ΔR
Load Life	± (3% + .05%) ΔR
Terminal Strength	± (1% + .05Ω) ΔR

at a maximum operating temperature of 350°C. ΔR maximum figures are considerably lower when tested at a maximum operating temperature of 275°C

POWER RATING

Dale Model CW have two power ratings, depending on operating temperature and stability requirements.

CHARACTERISTIC U:

- 1. 275°C maximum hot spot temperature.
- 2. .5% maximum ΔR in 2000 hour load life.

CHARACTERISTIC V:

- 1. 350°C maximum hot spot temperature.
- 2. 3% maximum ΔR in 2000 hour load life.

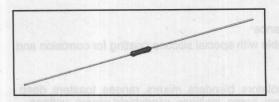
2	
	— Dale
	— Model
	— Value
	— Tolerance
	— Date code

0111		-			01	. =0/
CW	-	5	-	3	3k	± 5%
MODEL		WATTAGE		STYLE	RESISTANCE	TOLERAN

MODEL CW Wirewound Resistors

Commercial, Miniature, Coated





FEATURES

- · High performance for low cost
- High-temperature silicone coating
- · Complete welded construction
- · High power/size ratio
- Excellent stability in operation

STANDARD ELECTRICAL SPECIFICATIONS					
POWER RATING	RESISTANCE RANGE (Ohms)	MAXIMUM WORKING VOLTAGE*	MAXIMUM WEIGHT (Grams)		
.5 W	0.1-1.54k	19.6 V	.21		
1.0 W	0.1-5.50k	45.9 V	.34		
1.0 W	0.1-3.30k	37.4 V	.30		
3.0 W	0.1-8.38k	83.0 V	.65		
	POWER RATING .5 W 1.0 W	POWER RATING (Ohms) .5 W 0.1-1.54k 1.0 W 0.1-5.50k 1.0 W 0.1-3.30k	POWER RANGE (Ohms) WORKING VOLTAGE* .5 W 0.1-1.54k 19.6 V 1.0 W 0.1-5.50k 45.9 V 1.0 W 0.1-3.30k 37.4 V		

* Maximum working voltage determined at .0008" diameter wire resistance value.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ±5% standard 1 ohm and above. \pm 10% standard below 1 ohm. \pm 2% and \pm 3% available.

Temperature Coefficient: (- 55°C to + 275°C).

±90PPM/°C below 1 ohm. ±50PPM/°C 1 ohm - 9.9 ohm. ±30PPM/°C 10 ohm and above.

Dielectric Strength:

1000 VAC minimum for CW-2M.

500 VAC minimum for CW-1/2, CW-1, CW-1M.

Short Time Overload: 5 seconds at 5 times rated power.

MECHANICAL SPECIFICATIONS

Terminal Strength: 10 pound pull test = CW-2M. 5 pound pull test = CW-1/2, CW-1, CW-1M.

Solderability: 60/40 electro tin plated terminals to facilitate

soldering.

MATERIAL SPECIFICATIONS

Core: Heat conductive ceramic.

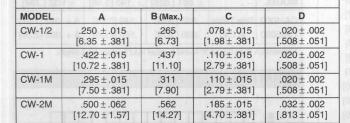
Element: Copper-nickel alloy or nickel-chrome alloy

depending on resistance value. End Caps: Weldable metal alloy.

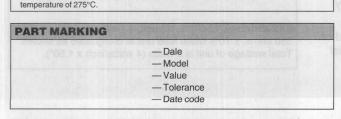
Coating: Special high-temperature silicone.

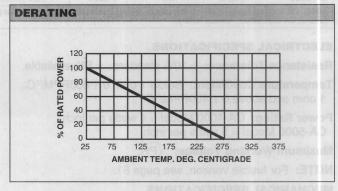
Standard Terminals: Tinned Copperweld®.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] 1.50 [38.10]



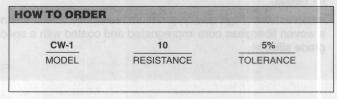
TEST	DALE® MAXIMUM
Temperature Coefficient	± 90 PPM/°C below 1Ω ± 50 PPM/°C 1.0Ω - 9.9Ω ± 30 PPM/°C 10Ω and above
Thermal Shock	± (2% + .05Ω) ΔR
Short Time Overload	± (2% + .05Ω) ΔR
Dielectric	\pm (.1% + .05Ω) ΔR
Low Temperature Storage	± (2% + .05Ω) ΔR
High Temperature Exposure	± (2% + .05Ω) ΔR
Moisture Resistance	\pm (2% + .05 Ω) Δ R
Shock	\pm (.2% + .05Ω) ΔR
Vibration	\pm (.2% + .05Ω) ΔR
Load Life	\pm (3% + .05 Ω) Δ R
Terminal Strength	$\pm (1\% + .05\Omega) \Delta R$





POWER RATING

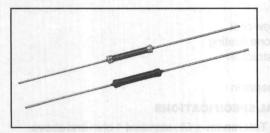
- 275°C maximum hotspot temperature.
- 3% maximum ΔR in 2000 hour load life.



MODEL CA Wirewound Resistors

Commercial, Power





FEATURES

- · Low cost, high performance
- CA-5000 Models available with special silicone coating for corrosion and abrasion protection

APPLICATIONS

Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Computers and power supplies.

STANDAR	D ELECTRIC	AL SPECIF	ICATIONS	DIMENSION A
MODEL	POWER RATING	OHMIC (Min.)	VALUE (Max.)	"A" ± .031 [.787]
CA-4050	2.0 W	.10	270	.50 [12.70]
CA-4055	2.2 W	.10	300	.55 [13.97]
CA-4060	2.4 W	.11	350	.60 [15.24]
CA-4070	2.8 W	.13	430	.70 [17.78]
CA-4080	3.2 W	.16	510	.80 [20.32]
CA-4090	3.6 W	.18	590	.90 [22.86]
CA-4100	4.0 W	.20	670	1.00 [25.40]
CA-4150	6.0 W	.33	1,080	1.50 [38.10]
CA-4200	8.0 W	.45	1,480	2.00 [50.80]
CA-4220	8.8 W	.50	1,640	2.20 [55.88]
CA-5050	2.5 W	.10	2,400	.50 [12.70]
CA-5055	2.75 W	.10	2,700	.55 [13.97]
CA-5060	3.0 W	.11	3,100	.60 [15.24]
CA-5070	3.5 W	.13	3,900	.70 [17.78]
CA-5080	4.0 W	.16	4,600	.80 [20.32]
CA-5090	4.5 W	.18	5,300	.90 [22.86]
CA-5100	5.0 W	.20	6,000	1.00 [25.40]
CA-5150	7.5 W	.33	9,700	1.50 [38.10]
CA-5200	10.0W	.45	13,300	2.00 [50.80]
CA-5220	11.0 W	.50	14,800	2.20 [55.88]

NOTE: CA-4000 Model also available with silicone coating, maximum resistance value will be the same as CA-5000 Model. Consult factory.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 10% standard. \pm 5% available. Temperature Coefficient: Below 1 ohm 0 \pm 800PPM/°C. 1 ohm and above 0 \pm 400PPM/°C.

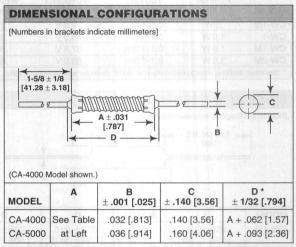
Power Rating: CA-4000 Model = 4 watts per inch.

CA-5000 Model = 5 watts per inch. **Maximum Working Voltage:** \sqrt{PR} . **NOTE:** For fusible version, see page 81.

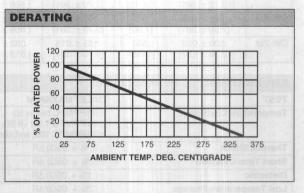
MECHANICAL SPECIFICATIONS

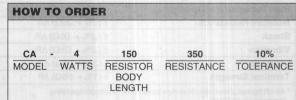
Leads: Standard lead material is tinned copper. Axial lead pull strength is 7 pounds. Lead forming available. Consult factory for needs.

Construction: High quality, premium resistance wire is wound on a woven fiberglass core impregnated and coated with a special grade silicone.



^{*} Dimension D on CA-5000 Model is clean lead to clean lead length.



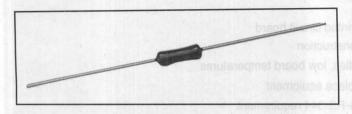


EXAMPLE: A 1.50" [38.10] unit, 4 watts per inch; 350 ohms, \pm 10% radial lead unit is designated as shown. Total wattage of unit is 6 watts (4 watts/inch x 1.50").

MODELS CA-1 and CA-2 Wirewound Resistors

Commercial, Power





FEATURES

- · High performance for low cost
- Axial leads
- Special grade silicone for additional environmental protection
- Auto insertable
- Value and tolerance printed

APPLICATIONS

Kitchen appliances: Percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: Horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: Radios, televisions. Also computers and power supplies.

ELECTRICAL SPECIFICATIONS

Resistance Range:

CA-1 = .1 ohm to 1000 ohm. CA-2 = .1 ohm to 2400 ohm.

Resistance Tolerance:

±10% standard. ±5% available.

Temperature Coefficient:

- ±600PPM/°C below 1 ohm.
- ±300PPM/°C 1 ohm and above.

Power Rating:

CA-1 = 1 watt. CA-2 = 2 watt.

Maximum Working Voltage: √PR.

Dielectric Withstanding Voltage: 600 V RMS.

MECHANICAL SPECIFICATIONS

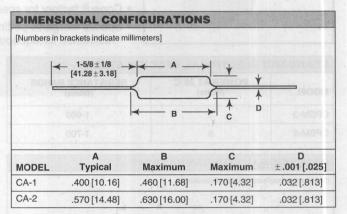
Terminal Strength: 7 pound pull test.

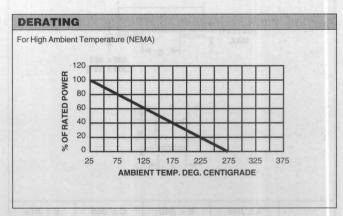
MATERIAL SPECIFICATIONS

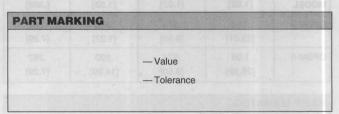
Standard Terminals: Tinned copper.

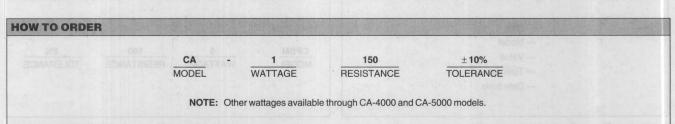
CONSTRUCTION

The CA-1 and CA-2 models have a high quality, premium resistance wire wound on woven fiberglass core, impregnated and coated with a special grade silicone for added environmental protection. For other sizes/wattage ranges, see Model CA.





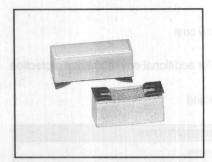




MODEL CPSM **Wirewound Resistors**

Commercial, Power, Surface Mount

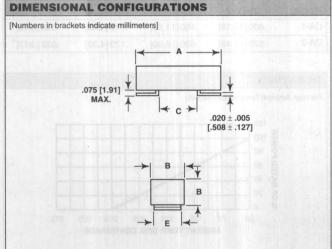




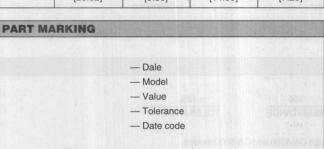
FEATURES

- · Direct mounting on printed circuit board
- Fireproof inorganic construction
- · High wattage capabilities, low board temperatures
- · Suitable for pick and place equipment
- Meets or exceeds EIA-RS-344 requirement
- · Consult factory for special applications
- · Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems

STANDARD ELECTRICAL SPECIFICATIONS				
MODEL	POWER AT 25°C (Watts)	RESISTANCE RANGE (Ohms)		
CPSM-3	3	.1-600		
CPSM-5	5	.1-700		



MODEL	A ± .040	B ± .040	C ± .060	E ± .012
	[1.02]	[1.02]	[1.52]	[.305]
CPSM-3	.906	.374	.500	.287
	[23.01]	[9.50]	[1.27]	[7.29]
CPSM-5	1.06	.374	.590	.287
	[26.92]	[9.50]	[14.99]	[7.29]



ELECTRICAL SPECIFICATIONS

Power Rating: 3 and 5 watt.

Resistance Tolerance: \pm 10%, \pm 5%.

Temperature Coefficient: Below 1 ohm, 0 ± 800PPM/°C.

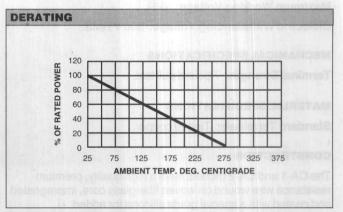
1 ohm and above, 0 ± 400PPM/°C.

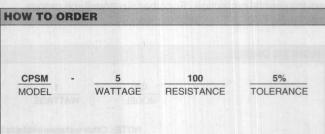
Maximum Working Voltage: √PR.

Operating Temperature: - 55°C to + 275°C.

MATERIAL SPECIFICATIONS

Construction: Resistance wire is a high quality, premium grade wound onto a woven core. Tin plated terminals are crimped to wound core. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.





STAND	STANDARD ELECTRICAL SPECIFICATIONS					
MODEL	WATTAGE RATING	EIA STANDARD RS-344 TYPE	RESISTANCE RANGE (Ohms)			
CP-2	2	CRU2A	.1-2.4k			
CP-2-3	2		.1-2.4k			
CP-3	3	CRU3	.1-7.5k			
CP-3-3	3	to 01 3/Mgs	.1-7.5k			
CP-5	5	CRU5	.1-8.5k			
CP-5-3	5	ND: 1000 VA	.1-8.5k			
CP-7	7	CRU7	.1-18k			
CP-7-3	7	entition <u>e</u> : × 55°	.1-18k			
CP-10	10	CRU10	.1-30k			
CP-10-3	10	in balkina mat	.1-30k			
CP-15	15	CRU15	.1-30k			
CP-15-3	15		.1-30k			
CP-20	20	unique d'idiler	.1-30k			
CP-20-3	20	vendib <u>e</u> rglass	.1-30k			
CP-22	22	AN OLD OUTSOLD	.1-30k			
CP-22-3	22	in Pantaga vilate	.1-30k			

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 10% standard. ± 5% available.

Temperature Coefficient:

Below 1 ohm 0 ± 800PPM/°C (Typical). 1 ohm and above 0 ± 400PPM/°C (Typical).

Maximum Working Voltage: VPR.

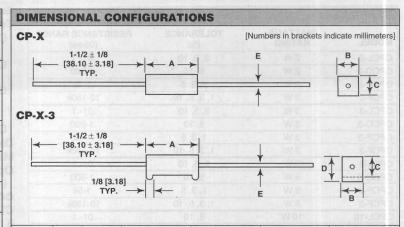
Operating Temperature: - 55°C to + 275°C.

MECHANICAL SPECIFICATIONS

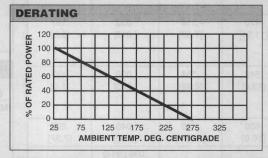
Terminal Strength: 5 pounds minimum.

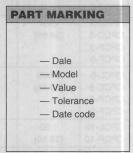
Construction: Resistance wire is a high quality, premium grade wound onto a woven fiberglass core. Terminals are tinned copper crimped to the wound core with a special alloy cap. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.

NOTE: CP-(X)F resistors can reliably function both as a fuse and as a wirewound resistor. Such components involve compromise between fusing and resistive functions and, therefore, each design should be tailored to the application to insure optimum performance. These resistors are similar in appearance to the CP resistors, but are manufactured with special materials and processes conforming to performance required. Contact factory for design assistance.



MODEL	$A \pm 1/32 [.790]$	B ± 1/32 [.790]	C ± 1/32 [.790]	D ± 1/32 [.790]	E ± .001 [.025]
CP-2	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	36.01	.032 [.813]
CP-2-3	11/16 [17.46]	1/4 [6.35]	1/4 [6.35]	5/16 [7.94]	.032 [.813]
CP-3	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]		.036 [.914]
CP-3-3	7/8 [22.22]	5/16 [7.94]	5/16 [7.94]	3/8 [9.52]	.036 [.914]
CP-5	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	-X328	.036 [.914]
CP-5-3	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	13/32 [10.32]	.036 [.914]
CP-7	1-25/64 [35.32]	3/8 [9.52]	11/32 [8.73]		.036 [.914]
CP-7-3	1-25/64 [35.32]	3/8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.914]
CP-10	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]		.036 [.914]
CP-10-3	1-7/8 [47.62]	3/8 [9.52]	11/32 [8.73]	15/32 [11.91]	.036 [.914]
CP-15	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	-	.036 [.914]
CP-15-3	1-7/8 [47.62]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.914]
CP-20	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	and the last of th	.036 [.914]
CP-20-3	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.914]
CP-22	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	7 - 1 - 1 TUS.	.036 [.914]
CP-22-3	2-1/2 [63.50]	1/2 [12.70]	1/2 [12.70]	5/8 [15.88]	.036 [.914]



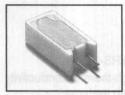


OW TO O	RDER			1990
CP MODEL	- 5 WATTAGE	3 MOUNTING PADS	100 RESISTANCE	±10%
WODEL	WATTAGE	IF DESIRED	TILOIOTANOL	TOLLITATIOL

MODELS CPCL, CPCC, CPCP, CPCF Wirewound Resistors

Commercial, Power, Vertical Mount





FEATURES

- Space saving
- · Direct mounting on printed circuit board
- · Meets or exceeds requirements of EIA-Standard RS-344

ELECTRICAL SPECIFICATIONS Temperature Coefficient:		aqueous t	oard	wasn sy	sten	ns
Temperature Coefficient:	EL	ECTRICAL	SPE	CIFICA	TION	NS
	Te					

· Fireproof inorganic construction

CPCL-X: ± 400PPM/°C, .01 ohm - .049 ohm. ± 100PPM/°C, .05 ohm - .1 ohm.

 Special inorganic potting compound provides high thermal conductivity and moisture resistance for

CPCC-X: ±800PPM/°C, .1 ohm - .99 ohm. ±400PPM/°C, 1 ohm - 100 ohm.

CPCP-X: ± 90PPM/°C, .1 ohm - .99 ohm.

± 50PPM/°C, 1 ohm - 9.9 ohm. ± 20PPM/°C, 10 ohm and above.

CPCF-X: ±50PPM/°C, 10 ohm - 150 kilohm.

Dielectric Strength: 1000 VAC Maximum Working Voltage: VPR.

Operating Temperature: - 55°C to + 275°C.

(- 55°C to + 225°C for CPCF model.)

CONSTRUCTION

CPCL: A completely welded assembly using a nickel-chrome alloy element, with tinned copper terminals.

CPCC: A high quality, premium resistance wire is wound onto a woven fiberglass core. Terminals are tinned copper crimped to the woven core with a brass alloy cap.

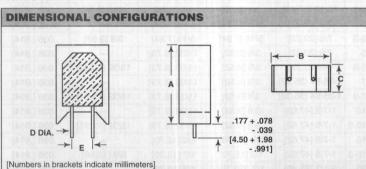
CPCP: A completely welded assembly using a ceramic core, copper-nickel or nickel-chrome alloy element, with tinned Copperweld® terminals. Non-inductive styles available upon request. Contact factory.

CPCF: A high grade metal film element utilizing a ceramic core. Terminals are solder-coated copper. All assemblies are potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.

PART MARK	ING	
william do	— Dale	- no lauviena
	— Model	
	— Value	
	— Tolerance	
	— Date code	

CPC	L -	2	.1	± 5%
MODEL	STYLE	WATTAGE	RESISTANCE	TOLERANCE
	ind hellor	A WATER OF		
	ow value	HISTORY CHOICE		
	commercia	Company of E. andrewelle.		
	fiberglass of	core)		
	recision	Figure 1		
1 3 3 3 3 3 3 3	ceramic co	re)		
F = F	*****			
	ceramic co	re)		

MODEL	WATTAGE	TOLERANCE (%)	RESISTANCE RANGE (Ohms)
CPCL-2	2 W	3, 5, 10	.011
CPCC-2	2 W	5, 10	.1-500
CPCP-2	2 W	1, 3, 5	.1-4k
CPCF-2	2 W	1, 3, 5, 10	10-150k
CPCL-3	3 W	3, 5, 10	.011
CPCC-3	3 W	5, 10	.1-800
CPCP-3	3 W	1, 3, 5	.1-5k
CPCF-3	3 W	1, 3, 5, 10	10-150k
CPCL-5	5 W	3, 5, 10	.011
CPCC-5	5 W	5, 10	.1-800
CPCP-5	5 W	1, 3, 5	.1-5k
CPCF-5	5 W	1, 3, 5, 10	10-150k
CPCL-10	10 W	5, 10	.011
CPCP-10	10 W	1, 3, 5	.1-8k
CPCC-10	10 W	5, 10	.2-1500

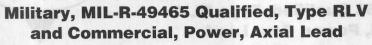


MODEL	A ± .020 [.508]	B ± .020 [.508]	C ± .010 [.254]	D ± .005 [.127]	E ± .059 [1.50]
CPCL-2 CPCC-2 CPCP-2 CPCF-2	.807 [20.50]	.430 [10.92]	.280 [7.11]	.032 [.813]	.197 [5.0]
CPCL-3 CPCC-3 CPCP-3 CPCF-3	.984 [24.99]	.470 [11.94]	.310 [7.87]	.032 [.813]	.197 [5.0]
CPCL-5 CPCC-5 CPCP-5 CPCF-5	1.003 [25.48]	.512 [13.0]	.354 [8.99]	.032 [.813]	.197 [5.0]
CPCL-10 CPCP-10	1.50 [38.10]	.630 [16.0]	.520 [13.21]	.040 [1.02]	.290 [7.37]
CPCC-10				.036 [.914]	

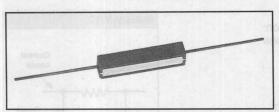
	-	03300			00000	
100 A	V	10.00	m		22	HO.
100			А	(6-	ш	186

Layered bulk packaging standard.

MODEL CPL Wirewound Resistors







FEATURES

- · Fireproof inorganic construction
- · Extremely low resistance values
- Complete welded construction
- MIL-R-49465 styles available
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems

STANDARD ELECTRICAL SPECIFICATIONS DALE MODEL DALE RATING **MIL-R-49465 TYPE** CPL-3 3 W CPL-3-3 CPL-3-6 RLV-40 CPL-5 5 W CPL-5-3 RLV-41 CPL-5-6 CPL-7 7 W CPL-7-3 CPL-7-6 RLV-42 CPL-10 10 W CPL-10-3 CPL-10-6 RLV-43 15 W CPL-15 CPL-15-3

ELECTRICAL SPECIFICATIONS

Resistance Range: .01 ohm to .10 ohm. (Resistance is measured 3/8" [9.50] from resistor body.)

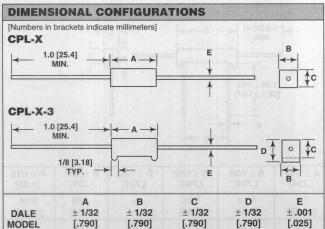
Resistance Tolerance: \pm 5% standard. Lower tolerances available. Military tolerances \pm 5%, \pm 10%, (Characteristic L).

Temperature Coefficient: Varies with resistance values. \pm 550PPM/°C maximum. Consult factory.

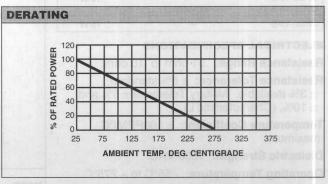
Dielectric Strength: 1000 VAC.

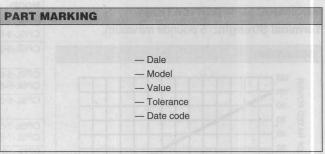
MECHANICAL SPECIFICATIONS

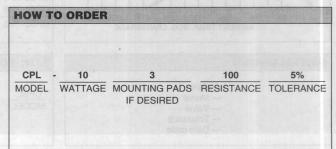
Terminal Strength: 5 pounds minimum.



		1182.5	[ber]		В
DALE MODEL	A ± 1/32 [.790]	B ± 1/32 [.790]	C ± 1/32 [.790]	D ± 1/32 [.790]	E ± .001 [.025]
CPL-3	7/8	5/16	5/16	16 <u>0.3</u> 1	.036
CPL-3-6	[22.22]	[7.94]	[7.94]		[.910]
CPL-3-3	7/8	5/16	5/16	3/8	.036
	[22.22]	[7.94]	[7.94]	[9.52]	[.910]
CPL-5 CPL-5-6	7/8 [22.22]	3/8 [9.52]	11/32 [8.73]	(S=0)	.036 [.910]
CPL-5-3	7/8	3/8	11/32	13/32	.036
	[22.22]	[9.52]	[8.73]	[10.32]	[.910]
CPL-7	1-25/64	3/8	11/32	1-1	.036
CPL-7-6	[35.32]	[9.52]	[8.73]		[.910]
CPL-7-3	1-25/64	3/8	11/32	15/32	.036
	[35.32]	[9.52]	[8.73]	[11.91]	[.910]
CPL-10	1-7/8	3/8	11/32		.036
CPL-10-6	[47.62]	[9.52]	[8.73]		[.910]
CPL-10-3	1-7/8	3/8	11/32	15/32	.036
	[47.62]	[9.52]	[8.73]	[11.91]	[.910]
CPL-15	1-7/8	1/2	1/2	(UG) - 3	.036
	[47.62]	[12.70]	[12.70]	(3) -	[.910]
CPL-15-3	1-7/8	1/2	1/2	5/8	.036
	[47.62]	[12.70]	[12.70]	[15.88]	[.910]



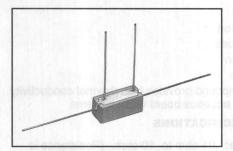




MODEL CPSL Wirewound Resistors

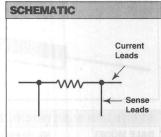
Military, MIL-R-49465 Qualified, Type RLV and Commercial, Power, Four Lead





FEATURES

- Fireproof inorganic construction
- Extremely low resistance values
- Current sensing
- Low temperature coefficients
- · High power/size ratio
- MIL-R-49465 styles available
- Complete welded construction
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems



STANDARD ELECTRICAL SPECIFICATIONS						
MODEL	MIL-R-49465 TYPE	WATTAGE RATING				
CPSL-3-5 CPSL-3-6	 RLV-20	3 W				
CPSL-3-3	ersisar min sand c	3 W				
CPSL-5-5 CPSL-5-6	 RLV-21	5 W				
CPSL-5-3		5 W				
CPSL-7-5 CPSL-7-6	 RLV-22	7 W				
CPSL-10-5 CPSL-10-6	 RLV-23	10 W				
CPSL-15-5		15 W				

ELECTRICAL SPECIFICATIONS

Resistance Range: .01 ohm to .10 ohm.

Resistance Tolerance: ± 5% standard.

± 3% available. Military Tolerance ± 5% and

± 10%, (Characteristic L).

Temperature Coefficient: ± 100PPM/°C

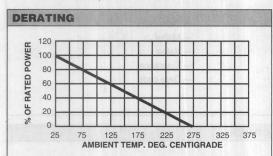
maximum.

Dielectric Strength: 1000 VAC.

Operating Temperature: - 55°C to + 275°C.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pounds minimum.



CING	
— Dale	
— Model	
— Value	
— Tolerance	
— Date code	
	— Model — Value — Tolerance

	UNAL CUI	NFIGURA	rions			
[Numbers in br	ackets indicate	millimeters]				0.655,275
CPSL-X a	-	.0 [25.4] HIN.	- A>	→ B	*	
	[S	1.50 ± .062 38.1 ± 1.57]			<u></u>	
CPSL-X-3		-	- F →			
	→ ¹	.0 [25.4] HIN.	- A →	→ c	+	
	-			D 0	В	
		1.50 ± .062 38.1 ± 1.57]		1		
			F-→	1	2.10	
MODEL		38.1 ± 1.57]	C ± 1/32 [.794]	D±1/32 [.794]	E±.001	F±1/10 [1.59]
CPSL-3-5	A ± 1/32	88.1 ± 1.57] ↓ E → ←	C ± 1/32	D ± 1/32		
CPSL-3-5 CPSL-3-6	A ± 1/32 [.794]	B ± 1/32 [.794]	C ± 1/32 [.794]	D ± 1/32	[. 025]	[1.59] 9/16
MODEL CPSL-3-5 CPSL-3-6 CPSL-3-3 CPSL-5-5 CPSL-5-6	A ± 1/32 [.794] 7/8 [22.22]	B ± 1/32 [.794] 5/16 [7.94]	C ± 1/32 [.794] 5/16 [7.94] 5/16	D±1/32 [.794] — 3/8	.036 [.914]	9/16 [14.30] 9/16
CPSL-3-5 CPSL-3-6 CPSL-3-3	A ± 1/32 [.794] 7/8 [22.22] 7/8 [22.22] 7/8	B±1/32 [.794] 5/16 [7.94] 5/16 [7.94] 3/8	C ± 1/32 [.794] 5/16 [7.94] 5/16 [7.94] 11/32 [8.73]	D±1/32 [.794] — 3/8	[.025] .036 [.914] .036 [.914] .036 [.914]	9/16 [14.30] 9/16 [14.30] 9/16
CPSL-3-5 CPSL-3-6 CPSL-3-3 CPSL-5-5 CPSL-5-6	A±1/32 [.794] 7/8 [22.22] 7/8 [22.22] 7/8 [22.22] 7/8	B±1/32 [.794] 5/16 [7.94] 5/16 [7.94] 5/16 [7.94] 3/8 [9.52] 3/8	C±1/32 [.794] 5/16 [7.94] 5/16 [7.94] 11/32 [8.73]	D±1/32 [.794] - 3/8 [9.52] - 7/16	[.025] .036 [.914] .036 [.914] .036 [.914]	9/16 [14.30] 9/16 [14.30] 9/16 [14.30] 9/16

CPSL	-	3	3	100	± 10%
MODEL		WATTAGE	MOUNTING PAD (IF DESIRED)	RESISTANCE	TOLERANCI

[8.73]

1/2

[12.70]

[.914]

.036

[.914]

1-3/8

[34.93]

CPSL-10-6

CPSL-15-5

[47.62]

[47.62]

[9.52]

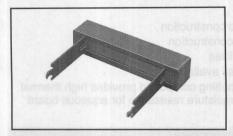
1/2

[12.70]

MODEL CPRWirewound Resistors

Commercial, Power, Radial Terminals





FEATURES

- Radial terminals
- Fireproof inorganic construction
- · Direct mounting on printed circuit board
- · Circuit board lock-in mounting tabs
- Fuse styles (Model RF) available
- Meets or exceeds requirements of EIA Standard RS-344
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems

STANDARI	ELECTRICAL SPECIFIC	CATIONS
MODEL	POWER AT 25°C	RESISTANCE RANGE (Ohms)
CPR-3	3 W	.1-600
CPR-5	5 W	.1-700
CPR-7	7 W	.1-1000
CPR-10	10 W	.1-1600
CPR-15	15 W	.1-1600
CPR-20	20 W	.15-2000

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] A Maximum $.020 \pm .005$ Misalignment [.508 ± .127] Material **Thickness** .180 ± .010 B C D E + .08 [+ 2.0] - .04 [- 1.0] ± .04 ± .04 ± .06 ±.012 ± .008 MODEL [± 1.0] [± 1.0] [± 1.5] [±.30] [± .20] CPR-3 .906 .500 .374 394 287 .055 [23.0] [9.50] [12.70] [10.01] [7.29][1.39] CPR-5 1.060 .374 .394 .287 .055 .590 [26.92] [9.50] [14.99] [10.01] [7.29] [1.39] CPR-7 1.398 .374 .886 .984 .287 .055 [24.99] [35.51] [9.50] [22.50] [7.29] [1.39] .374 CPR-10 .984 1.888 1.38 .287 .055 [24.99] [9.50] [7.29][47.96] [35.05] [1.39] CPR-15 1.888 492 1 28 1 18 394 106 [47.96] [10.01] [12.50] [29.97] [2.692] [32.51] CPR-20 2.498 .492 1.87 1.18 394 .106 [29.97] [63.45] [12.50] [47.50] [10.01] [2.692]

FUSE RESISTOR, MODEL CPR-(X)F

Dale[®] CPR-(X)F resistors can reliably function both as a fuse and as a wirewound resistor. Such components involve compromise between fusing and resistive functions and, therefore, each design should be tailored to the application to insure optimum performance. These resistors are wound with special wire conforming to performance required. Contact factory for design assistance.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 5%, \pm 10%.

Temperature Coefficient:
Below 1 ohm 0 ± 800PPM/°C.
1 ohm and above 0 ± 400PPM/°C.

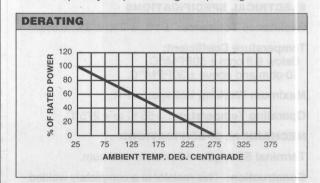
Power Rating: 3 watt to 20 watt.

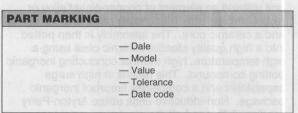
Maximum Working Voltage: √PR.

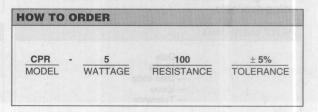
Operating Temperature: - 55°C to + 275°C.

MATERIAL SPECIFICATIONS

Construction: Resistance wire is a high quality, premium grade wound onto a woven fiberglass core. Tin plated terminals are crimped to wound core. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.



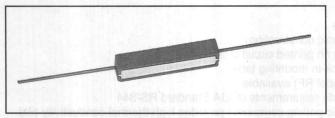




MODEL CPW **Wirewound Resistors**

Commercial, Power, Axial Lead





STANDARI	ELECTRICAL	SPECIFICATIONS	
MODEL	WATTAGE RATING	RESISTANCE RANGI (Ohms)	
CPW-2 CPW-2-3	2	.1-7k	
CPW-3 CPW-3-3	3 11990	.1-7.5k	
CPW-5 CPW-5-3	5	.1-8.5k	
CPW-7 CPW-7-3	7	.1-18k	
CPW-10 CPW-10-3	moin a 10 sulw e	.12-30k	
CPW-15 CPW-15-3	15	.12-30k	
CPW-20 CPW-20-3	20	.18-45k	

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 1%, \pm 2%, \pm 3%, \pm 5%.

Temperature Coefficient: Below 9.9 ohm ± 50PPM/°C 10 ohm and above ± 30PPM/°C.

Maximum Working Voltage: √PR.

Operating Temperature: - 55°C to + 275°C.

MECHANICAL SPECIFICATIONS

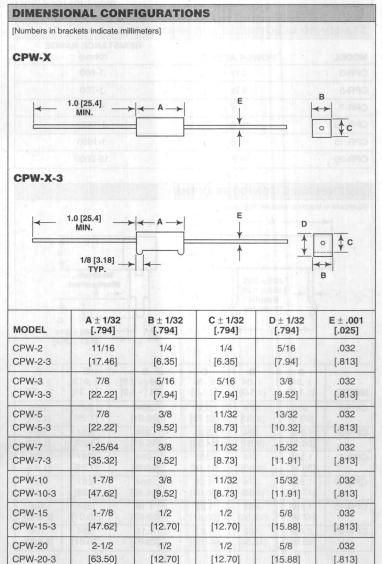
Terminal Strength: 10 pounds minimum.

Construction: This resistor is a completely welded unit utilizing an element of copper-nickel alloy or nickel-chrome alloy (depending on resistance value) and a ceramic core. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in high surge capabilities and a completely fireproof inorganic package. Non-inductive units utilize Aryton-Perry winding, with one-half the maximum resistance value available.

PART MARK	(ING	
	— Dale — Model — Date code — Value — Tolerance	

FEATURES

- · Fireproof inorganic construction
- Complete welded construction
- High surge capabilities
- Non-inductive styles available
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems



HOW TO O	RDE	1			
CPW MODEL	e com ce, sa com com color color color color	5 WATTAGE	3 MOUNTING PADS	500 VALUE	± 2% TOLERANCE
Non-inductive	availab	le. Contact fac	tory.		

MODEL CA-(X)F Wirewound Fuse Resistors

Commercial, Power



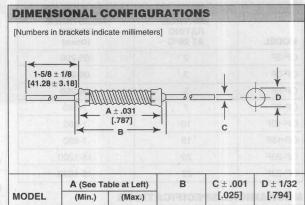


FEATURES

Multiple physical configurations available

Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Computers, power supplies and many others.

STANDAR	DIMENSION A			
	POWER	ОНМІС	VALUE	"A"
MODEL	RATING 25°C	(Min.)	(Max.)	± .031 [.787]
CA-4050F	2.0 W	.05	270	.50 [12.70]
CA-4055F	2.2 W	.06	300	.55 [13.97]
CA-4060F	2.4 W	.07	350	.60 [15.24]
CA-4070F	2.8 W	.08	430	.70 [17.78]
CA-4080F	3.2 W	.09	510	.80 [20.32]
CA-4090F	3.6 W	.10	590	.90 [22.86]
CA-4100F	4.0 W	.10	670	1.00 [25.40]
CA-4150F	6.0 W	.14	1080	1.50 [38.10]
CA-4200F	8.0 W	.18	1480	2.00 [50.80]
CA-4220F	8.8 W	.18	1640	2.20 [55.88]



	A (See Table at Left)		В	C ± .001	D ± 1/32
MODEL	(Min.)	(Max.)	PEGIFICA	[.025] [.79	[.794]
CA-4000F	.500 [12.70]	2.20 [55.88]	A + .062 [1.57]	.032 [.813]	.140 [3.56]

ELECTRICAL SPECIFICATIONS

Maximum Working Voltage: √PR.

Resistance Tolerance: \pm 10% standard. \pm 5% available.

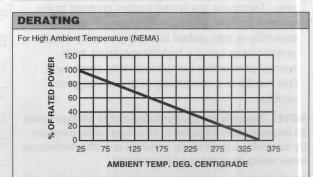
Power Rating: Model 4000 = 4 watts per inch.

MATERIAL SPECIFICATIONS

Leads: Standard lead material is tinned copper. Axial lead pull strength is 7 pounds.

Construction: Resistors have a high quality, premium resistance wire wound on woven fiberglass core impregnated and coated with a special grade silicone.

NOTE: Generally standard processed units will fuse before 60 seconds when subjected to 12 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished.



NOTE: Continuous power rating must be derated at high ambient temperatures per above curve.

HOW TO ORDER

350 CA 150F ± 10% RESISTOR RESISTANCE TOLERANCE MODEL WATTS BODY LENGTH AND FUSE **DESIGNATION**

EXAMPLE: A 1.50" [38.10] unit, 4 watts per inch; 350 ohm, ± 10% radial lead unit is designated as shown. Total wattage of unit is 6 watts, (4 watts/inch x 1.50" [38.10]).

Please include the following information. It will enable us to choose the best design for your application.

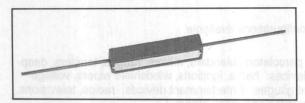
- 1. Operating wattage or current and ambient temperature. 2. Fusing wattage or current and maximum "blow" time,
- if applicable.
- Nominal resistance and maximum allowable resistance tolerance, 5% minimum.
- 4. Maximum allowable physical size.
- 5. Voltage to be interrupted.
- Frequency of power source, wave form and a brief description of your application.

Contact factory for design assistance.

MODEL CP-(X)F Wirewound Fuse Resistors

Commercial, Power, Axial Lead



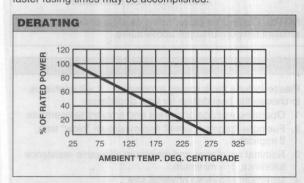


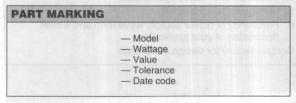
STANDAR	D ELECTRICAL SP	ECIFICATIONS
MODEL	WATTAGE RATING AT 25°C	RESISTANCE RANGE (Ohms)
CP-2F	2	.05-200
CP-3F	3	.06-250
CP-5F	5	.06-250
CP-7F	7	.1-550
CP-10F	10	.1-850
CP-15F	15	.1-850
CP-20F	20	.15-1200
CP-22F	22	.15-1200

MECHANICAL SPECIFICATIONS

Construction: Resistance wire is a high quality, premium grade wound onto a woven fiberglass core. Terminals are tinned copper crimped to the wound core with a special alloy cap. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.

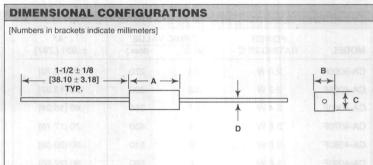
NOTE: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials and other techniques faster fusing times may be accomplished.





FEATURES

- · Fireproof inorganic construction
- Multiple physical configurations available
- Terminal strength 7 pound pull test
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems



Mounting pads available upon request. See CP product, page 75, for dimensions

MODEL	A ± 1/32	B ± 1/32	C ± 1/32	D + .001
	[± .794]	[± .794]	[± .794]	[+ .025]
CP-2F	11/16	1/4	1/4	.032
	[17.46]	[6.35]	[6.35]	[.813]
CP-3F	7/8	5/16	5/16	.036
	[22.22]	[7.94]	[7.94]	[.914]
CP-5F	7/8	3/8	11/32	.036
	[22.22]	[9.52]	[8.73]	[.914]
CP-7F	1-25/64	3/8	11/32	.036
	[35.32]	[9.52]	[8.73]	[.914]
CP-10F	1-7/8	3/8	11/32	.036
	[47.62]	[9.52]	[8.73]	[.914]
CP-15F	1-7/8	1/2	1/2	.036
	[47.62]	[12.70]	[12.70]	[.914]
CP-20F	2-1/2	1/2	1/2	.036
	[63.50]	[12.70]	[12.70]	[.914]
CP-22F	2-1/2	1/2	1/2	.036
	[63.50]	[12.70]	[12.70]	[.914]

HOW TO ORDER				
СР	0083	5F	100	± 5%
MODEL		WATTAGE AND FUSE	RESISTANCE	TOLERANCE
		DESIGNATION		

Please include the following information. It will enable us to choose the best design for your application.

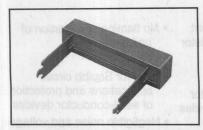
- 1. Operating wattage or current and ambient temperature.
- 2. Fusing wattage or current and maximum "blow" time. Also, minimum "blow" time, if applicable.
- Nominal resistance and maximum allowable resistance tolerance, 5% minimum.
- 4. Maximum allowable physical size.
- 5. Voltage to be interrupted.
- Frequency of power source, wave form and a brief description of your application.

Contact factory for design assistance.

MODEL CPR-(X)F Wirewound Fuse Resistors

Commercial, Power, Radial Terminal





FEATURES

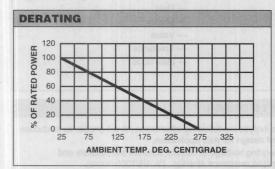
- · Fireproof inorganic construction
- · Direct mounting on printed circuit board
- · Circuit board lock-in mounting tabs
- · Multiple physical configurations available
- Terminal strength 7 pound pull test
- Special inorganic potting compound provides high thermal conductivity and moisture resistance for aqueous board wash systems

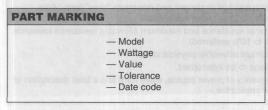
STANDARD ELECTRICAL SPECIFICATIONS			
MODEL	POWER AT 25°C (Watts)	RESISTANCE RANGE (Ohms)	
CPR-5F	5mrlo. 8.	.1-400	
CPR-7F	7	.1-550	
CPR-10F	10	.1-850	
CPR-15F	15	.1-850	
CPR-20F	20	.15-1100	

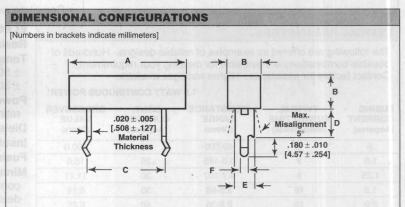
MECHANICAL SPECIFICATIONS

Construction: Resistance wire is a high quality, premium grade wound onto a woven fiberglass core. Tin plated terminals are crimped to wound core. The assembly is then potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package.

NOTE: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials, and other techniques faster fusing times may be accomplished.







CHAIR .	50.5	10-21-01	2.997		525	2.0
MODEL	A ± .040	B ± .040	C ± .060	D + .080	E ± .012	F ± .008
	[± 1.02]	[± 1.02]	[± 1.52]	[+ 2.03]	[± .305]	[± .203]
CPR-5F	1.06	.374	.590	.394	.287	.055
	[26.92]	[9.50]	[14.99]	[10.01]	[7.29]	[1.40]
CPR-7F	1.398	.374	.886	.984	.287	.055
	[35.51]	[9.50]	[22.50]	[24.99]	[7.29]	[1.40]
CPR-10F	1.888	.374	1.38	.984	.287	.055
	[47.96]	[9.50]	[35.05]	[24.99]	[7.29]	[1.40]
CPR-15F	1.888	.492	1.28	1.18	.394	.106
	[47.96]	[12.50]	[32.51]	[29.97]	[10.01]	[2.69]
CPR-15F	2.498	.492	1.87	1.18	.394	.106
	[63.45]	[12.50]	[47.50]	[29.97]	[10.01]	[2.69]

HOW TO ORDER CPR - 5F 100 ±5% MODEL AND FUSE DESIGNATION TOLERANCE TOLERANCE

Please include the following information. It will enable us to choose the best design for your application.

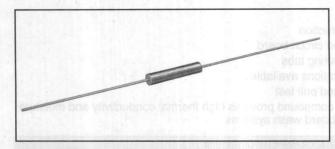
- 1. Operating wattage or current and ambient temperature.
- Fusing wattage or current and maximum "blow" time. Also, minimum "blow" time, if applicable.
- Nominal resistance and maximum allowable resistance tolerance, 5% minimum.
- 4. Maximum allowable physical size.
- 5. Voltage to be interrupted.
- Frequency of power source, wave form and a brief description of your application.

Contact factory for design assistance.

MODEL RS-1F Wirewound Fuse Resistors

Molded, Fast Acting
Custom Designed For Your Application





FEATURES

- Low temperature coefficient typical of wirewound resistor
- High temperature silicone molded package
- Performs function of resistor and series fuse and provides predictable fusing times
- Complete welded construction
- No flaming or distortion of unit under fusing conditions
- Ideal for Squibb circuit applications and protection of semi-conductor devices
- Negligible noise and voltage coefficient

TYPICAL PARAMETERS

The following are offered as examples of reliable designs. Hundreds of possible combinations are available for meeting your requirements. Contact factory for assistance. Higher wattages available.

1.0 WATT CONTINUOUS POWER*

FUSING CURRENT (Amperes)	TYPICAL FUSING TIME (Milliseconds)	RESISTANCE RANGE (Ohms)	CONT. CURRENT (Amperes)	CROSSOVER VALUE (Ohms)
.5	4	49-500	.10	100.0
1.0	9	6.8-185	.25	16.0
1.25	8	4.7-107	.30	11.11
1.5	15	3.5-68	.35	8.16
2.0	15	2.2-35	.40	6.25
2.5	23	1.7-23	.45	4.94
3.0	48	1.1-12	.55	3.31
4.0	47	.72-6.44	.75	1.78
6.0	70	.35-2.17	1.0	1.0
8.0	48	.29-1.61	1.25	.64
10.0	50	.23-1.16	1.50	.44
15.0	35	.1982	1.75	.33
20.0	46	.1242	2.0	.25

* The Continuous Current Rating applies only to values equal to or less than the Crossover Value. The Continuous Power Rating applies only to values equal to or higher than the Crossover Value.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: $\pm 3\%$, $\pm 5\%$, $\pm 10\%$.

Temperature Coefficient:

 $\pm\,50\mbox{PPM/}^{\circ}\mbox{C},\,1$ ohm thru 9.9 ohm.

± 30PPM/°C, 10 ohm and up.

Power Rating: 1.0 watt standard, higher power

ratings available.

Dielectric Strength: 750 VAC.

Insulation Resistance: 10,000 Megohm minimum dry.

Fusing Times: 1 millisecond to 1 second.

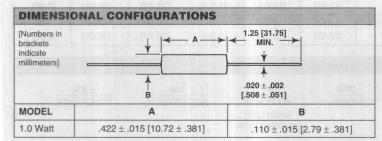
Minimum Fusing Current: Approximately 4 times the continuous operating current obtainable on some designs. Larger ratios produce better designs.

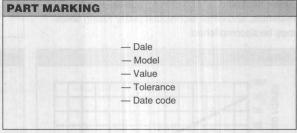
MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

NOTE: No standard part numbers are shown since these units are tailored to meet individual needs. Note that the inherent compromise involved between resistive and fusing functions sometimes makes certain exact combinations unattainable. However, in nearly all cases, this does not prevent the production of a functional, reliable fuse resistor thoroughly capable of meeting application requirements.





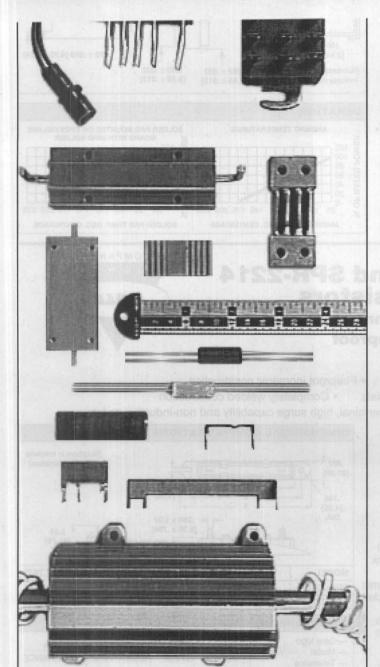
DERATING 120 100 80 40 40 25 75 125 175 225 275 325 AMBIENT TEMP. DEG. CENTIGRADE

NOTE: Continuous power rating must be derated at high ambient temperature per above curve.

HOW TO ORDER

Please include the following information. It will enable us to choose the best design for your application,

- Operating wattage or current, ambient temperature and required resistance stability. (% ΔR/1000 hours).
- 2. Fusing wattage or current and maximum "blow" time. Also, minimum "blow" time, if applicable.
- Nominal resistance and maximum allowable resistance tolerance, (5% to 10% preferred).
- 4. Maximum allowable physical size.
- 5. Voltage to be interrupted.
- Frequency of power source, wave form and a brief description of your application.



The list below shows some of the options and combinations which can be achieved:

WIREWOUND OPTIONS

Construction: Heat sink, silicone coated, epoxy or silicone molded (single or multi-element), hermetic seal (ceramic tube or metal can encapsulated), clip mounted or fireproof inorganic construction.

Leads: Radial and axial type, special materials and dimensions, spaded, threaded, insulated, quick-disconnect eyelet, printed circuit, ferrule.

Matching: By pairs or sets for T.C., tolerance or ratio.

Special Types: Extended low or high resistance range, adjustable, low reactance, special wire alloys, very low or high T. C., high stability, special tolerances, tapped, water cooled, temperature sensitive, inductive.

Pre-conditioning: Power aging, temperature cycling, temperature and power, short-time overload, thermal shock, X-ray, temperature aging.

Shunts: Low value, 4-terminal resistors built to customer specifications or designed by our engineers to meet your current sensing requirements.

Fuse Resistors: Our hybrid components designed to act as an ordinary resistor under normal circuit conditions, and as a fuse under fault conditions. Dale offers a variety of standard types, physical sizes and basic styles. Each application should be referred to Dale for an individual design to insure optimum performance in any particular circuit. See our special pages on fuse resistors.

For Fast Attention to Your Special Resistor Requirements, Call or Write:

Special Products Section
Wirewound Division
DALE ELECTRONICS, INC.
1122 23rd Street, Columbus, NE 68601-3647
Phone (402) 563-6506

Above 1 ohm, ± 50PPM/°C.

Power Rating: 5 watts.

Maximum Working Voltage: √PR.

MATERIAL SPECIFICATIONS

Element: Copper-nickel alloy or nickel-chrome.

Terminals: Copper, tinned with high temperature solder.

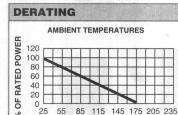
Case: High quality ceramic.

Potting Compound: High temperature, thermally conductive, moisture resistant and inorganic, creating a

completely fireproof package.

Packaging: Bulk pack standard. Tube pack available.

Solderability: Hot solder dipped terminals to facilitate soldering.



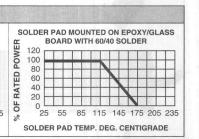
AMBIENT TEMP. DEG. CENTIGRADE

.100 ± .010

[2.54 ± .254]

[Numbers in brackets

indicate millimeters]



 $.250 \pm .032$

[6.35 ± .813]

 $.262 \pm .032$

 $[6.65 \pm .813]$

.170 ± .010 [4.32 ± .254]

MODELS SPR-2213 and SPR-2214 Wirewound Resistors

Special Purpose, Commerical High Power, Flameproof





FEATURES

- High power/size ratio
- Fireproof inorganic construction
- Quick disconnect terminals
- · Completely welded construction
- Options include center terminal, high surge capability and non-inductive styles

ELECTRICAL SPECIFICATIONS

Resistance Range: SPR-2213, .5 ohm to 24 kilohm.

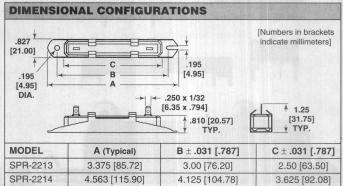
SPR-2214, 1 ohm to 44 kilohm. Resistance Tolerance: \pm 5%, \pm 10%. T. C.: \pm 50PPM/°C, below 10 ohm. \pm 30PPM/°C, 10 ohm and above. Dielectric Strength: 2500 VAC.

Maximum Working Voltage: \sqrt{PR} .

Operating Temperature: - 55°C to + 275°C.

Wattage Rating: SPR-2213, 70 watts with heat sink and 40 watts without heat sink. SPR-2214, 100 watts with heat sink and 50 watts without heat sink.

Construction: A completely welded assembly using a ceramic core, copper-nickel or nickel-chrome alloy element, with nickel plated steel terminals. The element is potted into a high quality steatite ceramic case using a high temperature, high thermal conducting inorganic potting compound. The result is a completely fireproof inorganic package. The unit is centered and secured with a zinc-plated steel bracket, designed for maximum dielectric strength, heat transfer and ease of mounting.

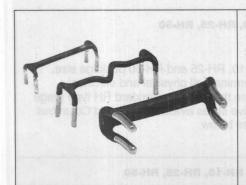


PART MARKING	HOW TO ORDER				
Dale logo Model — Value Tolerance		2214 STYLE	160 RESISTANCE	5% TOLERANCE	
— Date code	Skin Packed Standard				

SPECIAL PURPOSEWirewound Resistors

Four Terminal, Current Sensing For Instrumentation and Control





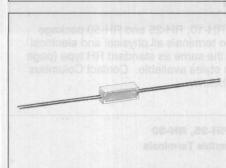
MODELS SPR-676 SPR-2039, SPR-2093

Wirewound Resistors

Special Purpose
Open Style
Designed for
Printed Circuit Boards

STANDARD ELECTRICAL SPECIFICATIONS					
MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	TYPICAL TOLERANCE		
SPR-676	1	.001505	.5%		
SPR-2039	3.5	.003305	1%		
SPR-2093	13*	.0005002	1.5%		
* Limited to 1	15 Amne				

DIMENSIONAL CONFIGURATIONS				
MODEL	HOLE PATTERN	TERMINAL DIAMETER		
SPR-676	.20 [5.08] x .70 [17.78]	.040 [1.02]		
SPR-2039	.25 [6.35] x 1.0 [25.4]	.051 [1.30]		
SPR-2093	.25 [6.35] x 1.0 [25.4]	.081 [2.06]		



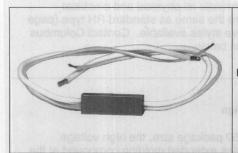
MODELS SPR-2073 SPR-2123, SPR-2091

Wirewound Resistors

Special Purpose
Ceramic Potted
Designed for
Rugged Applications

STANDARD ELECTRICAL SPECIFICATIONS					
MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE		
SPR-2073	3	.00125	1%		
SPR-2123	5	.00125	1%		
SPR-2091	10	.00125	1%		

DIMENSIONAL CONFIGURATIONS					
MODEL	LENGTH	WIDTH	HEIGHT	TERMINAL	
SPR-2073	.875 [22.22]	.312 [7.94]	.312 [7.94]	.040 x 2.0	
SPR-2123	.875 [22.22]	.375 [9.52]	.344 [8.73]	[1.02 x 50.80]	
SPR-2091	1.875 [47.62]	.375 [9.52]	.344 [8.73]	[1.02 x 30.00]	



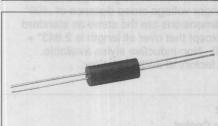
MODEL SPR-383 Wirewound Resistors

Special Purpose
Heat Sink Style, Silicone Molded
Aluminum Housed Unit
Featuring Flexible Teflon
Insulated Leads to Meet
Those Tough Environmental
Requirements

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE
SPR-383	3-5*	.00505	1%
* 3 watts fre	e air, 5 watts he	at sink.	

DIMÉNSIONAL CONFIGURATIONS MODEL LENGTH WIDTH HEIGHT TERMINAL SPR-383 1.0 [25.40] .312 [7.94] .312 [7.94] 14 AWG or 22 AWG x 6 [152.38]



MODEL SPR-1005 Wirewound Resistors

Special Purpose Silicone Molded SPR-1005-26/MIL-R-49465/1 Qualified, Type RLV-10

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE	(Ohms		TOLERANCE
SPR-1005	5*	.0008-	.5	1%
* Limited to 2	5 Amps.			
DIMENS	IONAL CO	NFIGURA'	TIONS	S. S. C. Staniel
MODEL	LENGTH	WIDTH	TE	RMINAL
SPR-1005	.975 [24.77]	.380 [9.65]	.040 x 2.0	0 [1.02 x 50.80]



MODEL SPR-1014

Wirewound Resistors

Special Purpose Fuse Clip Mounted Style

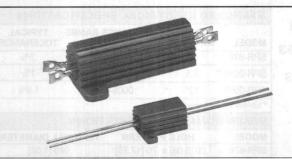
FEATURES

Designed for use in equipment requiring an easily changeable resistor for calibration of equipment to specific installation requirements. The 1 1/4" x 1/4" [31.75 x 6.35] unit mounts in a standard fuse clip. The value range is 1 ohm to 1 kilohm in 5% or 10% tolerance and dissipates 3 watts at 25°C. Extended value range and lower tolerances are available on request.

SPECIAL PURPOSE Wirewound Resistors

Housed, Terminal Variations





MODELS RH-10, RH-25, RH-50

Four Terminals

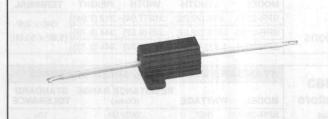
Available in RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same as standard RH type (page 52). Non-inductive styles available. Contact Columbus factory at address below.



MODELS RH-5, RH-10, RH-25, RH-50

Threaded Terminals

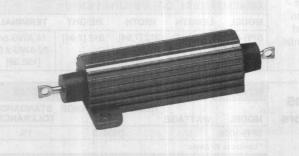
Available in RH-5, RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same as standard RH type (page 52). Non-inductive styles available. Contact Columbus factory at address below.



MODELS RH-10, RH-25, RH-50

Teflon Insulated, Flexible Terminals

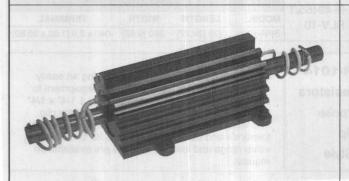
Available in RH-10, RH-25 and RH-50 package size. Except for the terminals all physical and electrical characteristics are the same as standard RH type (page 52). Non-inductive styles available. Contact Columbus factory at address below.



MODEL RH-50

High Voltage Design

Available in RH-50 package size, the high voltage design incorporates extended molding compound at the terminals to give longer voltage creep distance of .405" [10.29]. Physical dimensions are the same as standard RH-50 (page 52) except that over all length is 2.843" + .032" [72.21 + .813]. Non-inductive styles available. Contact Columbus factory at address below.



MODEL SPR-1002

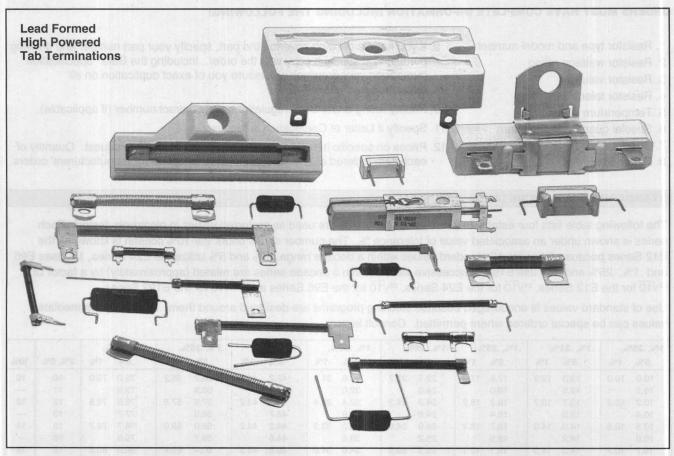
High Wattage, Water Cooled

The SPR-1002 is a variation of the NH-250 (non-inductive) resistor that incorporates water cooling for increased power dissipation. The unit is rated at 450 watts when mounted on the standard NH-250 except terminals are #12 AWG teflon insulated flexible wire and 1/2" [12.70] diameter copper water cooling tube extends 1.5" [38.10] from each end. Electrical characteristics are same as standard NH-250 (page 52) except that the dielectric strength is 3000 VRC.

SPECIAL PURPOSEWirewound Resistors

Engineered to Your Special Requirements





LEAD FORMED PRODUCTS

A variety of standard lead forms are available for use where auto-insertion is not available or practical. Forms vary from simple right angle lead bends, vertical hair pin bends, to lock in styles that lock into the circuit board. This provides for a positive stand-off while holding the part securely in place during further handling.

HIGH POWERED RESISTORS

High power, low cost, ceramic cased resistors are available in a range of wattage ratings and termination styles. From 25 watts to 50 watts (even more with proper heat sinks) these resistors can be supplied with wire leads or quick disconnects and several mounting techniques. Frequently used in power supplies, motor controllers, and automotive applications, these products can be custom tailored to individual needs.

TAB TYPE TERMINATIONS

These resistors, widely used in automotive applications, provide high wattage and easy mounting by directly mounting to binding posts, soldering or welding, or by use of quick disconnect terminals.

BRACKETS CHASSIS MOUNTS CIRCUIT BOARD MOUNTING

A variety of brackets are available for mounting ceramic cased resistors directly to a chassis or heat sink, or directly onto a circuit board. Benefits include higher heat dissipation and positive mounting where quick disconnect or hand solderable terminals are used, or a very minimal amount of board space is available making a vertical mount necessary. In addition, several styles can be supplied for mounting in circuit boards, with or without a ceramic case.

Contact Dale[®] Engineering For All Your Special Purpose Wirewound Resistor Requirements:

- Heaters
- · High T. C.
- Surface Mount
- Special Lead Forming
- Special Length, Flexible Resistors
- Fusible Types
- Current Sensing
- · Special Mounting
- High Pulse Capabilities
- Lightening Surge/Power Cross Capabilities

CHECKLIST FOR ORDERING FILM RESISTORS



ORDERS MUST HAVE COMPLETE INFORMATION INCLUDING THE FOLLOWING:

- 1. Resistor type and model number
- 2. Resistor wattage rating
- 3. Resistor value
- 4. Resistor tolerance
- 5. Temperature Coefficient
- 6. Special quantity of each item
- 7. Specify routing
- 8. Desired delivery

- If you have a drawing covering the part, specify your part number and drawing number and supply a copy with the order. Including the Dale[®] specification number on your drawings will assure you of exact duplication on all future orders.
- 10. Priority rating under DMS regulations and contract number (if applicable).
- 11. Specify if Letter of Certification is required.
- 12. Prices on specific items and quantities will be quoted on request. Quantity of each item ordered at one time determines unit price for manufacturers' orders.

STANDARD DECADE RESISTANCE VALUES

The following table lists four established number series which are used as preferred values in electronic design. Each series is shown under an associated value of tolerance %. The number series under the 10% column is known as the E12 Series because there are 12 standard values within a decade range. 2% and 5% utilize the E24 Series, 1% uses E96 and .1%, .25% and .5% use E192. Successive values within a decade series are related (approximately) by a factor of $^{12}\sqrt{10}$ for the E12 Series, $^{24}\sqrt{10}$ for the E24 Series, $^{96}\sqrt{10}$ for the E96 Series and $^{192}\sqrt{10}$ for the E192 Series.

Use of standard values is encouraged because stocking programs are designed around them. However, intermediate values can be special ordered where permitted. Consult factory.

1%, .25	%,	.1%, .25	%,	.1%, .25	%,	.1%, .25	%,	.1%, .25	%,	.1%, .25	%,	.1%, .25	%,	.1%, .25	%,		
.5%	1%	.5%	1%	.5%	1%	.5%	1%	.5%	1%	.5%	1%	.5%	1%	.5%	1%	2%, 5%	10%
10.0	10.0	13.3	13.3	17.8	17.8	23.7	23.7	31.6	31.6	42.2	42.2	56.2	56.2	75.0	75.0	10	10
10.1		13.5		18.0		24.0		32.0		42.7		56.9		75.9		11	-
10.2	10.2	13.7	13.7	18.2	18.2	24.3	24.3	32.4	32.4	43.2	43.2	57.6	57.6	76.8	76.8	12	12
10.4		13.8		18.4		24.6		32.8		43.7		58.3		77.7		13	-
10.5	10.5	14.0	14.0	18.7	18.7	24.9	24.9	33.2	33.2	44.2	44.2	59.0	59.0	78.7	78.7	15	15
10.6		14.2		18.9		25.2		33.6		44.8		59.7		79.6		16	_
10.7	10.7	14.3	14.3	19.1	19.1	25.5	25.5	34.0	34.0	45.3	45.3	60.4	60.4	80.6	80.6	18	18
10.9		14.5		19.3		25.8		34.4		45.9		61.2		81.6		20	_
11.0	11.0	14.7	14.7	19.6	19.6	26.1	26.1	34.8	34.8	46.4	46.4	61.9	61.9	82.5	82.5	22	22
11.1		14.9		19.8		26.4		35.2		47.0		62.6		83.5		- 24	DEW !
11.3	11.3	15.0	15.0	20.0	20.0	26.7	26.7	35.7	35.7	47.5	47.5	63.4	63.4	84.5	84.5	27	27
11.4		15.2		20.3		27.1		36.1		48.1		64.2		85.6		30	diction i
11.5	11.5	15.4	15.4	20.5	20.5	27.4	27.4	36.5	36.5	48.7	48.7	64.9	64.9	86.6	86.6	33	33
11.7		15.6		20.8		27.7		37.0		49.3		65.7		87.6		36	-
11.8	11.8	15.8	15.8	21.0	21.0	28.0	28.0	37.4	37.4	49.9	49.9	66.5	66.5	88.7	88.7	39	39
12.0		16.0		21.3		28.4		37.9		50.5		67.3		89.8		43	-
12.1	12.1	16.2	16.2	21.5	21.5	28.7	28.7	38.3	38.3	51.1	51.1	68.1	68.1	90.9	90.9	47	47
12.3		16.4		21.8		29.1		38.8		51.7		69.0		92.0		51	13.071
12.4	12.4	16.5	16.5	22.1	22.1	29.4	29.4	39.2	39.2	52.3	52.3	69.8	69.8	93.1	93.1	56	56
12.6		16.7		22.3		29.8		39.7		53.0		70.6		94.2		62	na n
12.7	12.7	16.9	16.9	22.6	22.6	30.1	30.1	40.2	40.2	53.6	53.6	71.5	71.5	95.3	95.3	68	68
12.9		17.2		22.9		30.5		40.7		54.2		72.3		96.5		75	in the same of
13.0	13.0	17.4	17.4	23.2	23.2	30.9	30.9	41.2	41.2	54.9	54.9	73.2	73.2	97.6	97.6	82	82
13.2		17.6		23.4		31.2		41.7		55.6		74.1		98.8		91	-

Standard resistance values are obtained from the decade table by multiplying by powers of 10. As an example, 13.3 can represent ohms, 133 ohms, 1.33k, 13.3k, 13.3k, 1.33 Megohm.

MODEL TNPWM Thin Film Chip Resistors

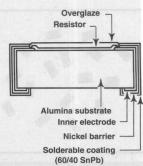
Military/Established Reliability
MIL-R-55342/7 Qualified, Type RM, Precision





FEATURES

- Internationally standardized size
- Meets requirements of MIL-R-55342
- Established Reliability Verified failure rate (contact factory)
- Operating temperature range is 55°C to + 150°C
- 8mm reel, tray or bulk packaging
- Flow solderable
- 100% screen tested
- Thin film resistance element and wraparound termination
- Inner electrode protection
- · Automatic placement compatibility



STANDARD ELECTRICAL SPECIFICATIONS									
DALE MODEL	MIL-R-55342 TYPE	MILITARY SHEET NUMBER	CHAR.	RESISTANCE RANGE (Ohms)	TOLERANCE				
TNPWM-1206	RM1206	07	Н	49.9-1M	1%, 2%, 5%				
			E, H	49.9-1M	1%, 2%				
			E, H	100-500k	0.1%, 1%, 2%				

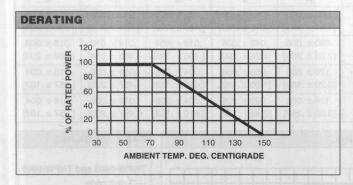
CODE	LETTI	ERS F	OR TO	LEF	ANCE A	ND M	IULTIPLIER
± 0.1%	± 1%	± 2%	± 5%	MUI	LTIPLIER	VAL	UE RANGE (Ohms)
Α	D	G	J	100	1		1-9xx
В	E	Н	K	200	1,000		1k-9xxk
C	F	T	L	1,	000,000		1M -9xxM
Examples 102A = 10 1B00 = 1k 100B = 10	$\Omega \Omega \pm 0.19$ $\Omega \Omega \pm 0.1\%$	10E0	$\theta = 49.9\Omega$ $\theta = 10k\Omega$: $\theta = 332\Omega$	± 1%	75G0 = 75Ω 10H0 = 10k 33H0 = 33k	Ω ± 2%	$68J0 = 68Ω \pm 5\%$ $10K0 = 10kΩ \pm 5\%$ $560K = 560kΩ \pm 5\%$

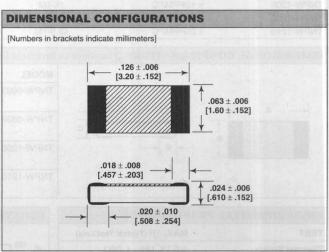
ELECTRICAL SPECIFICATIONS

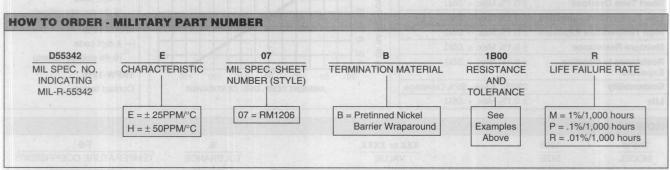
Power Rating at 70°C: .125 W.

Maximum Operating Voltage: 100 V.

Termination Material: Pretinned nickel barrier wraparound.



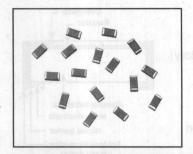




MODEL TNPW Thin Film Chip Resistors

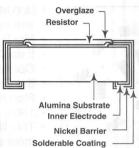
Industrial, Precision



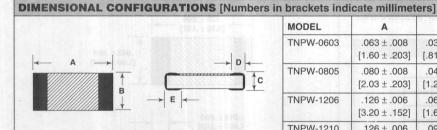


FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Reflow solderable
- Thin film resistance element
- Wraparound termination
- Inner electrode protection
- 8mm reel or bulk packaging
- Operating temperature range is 55°C to + 125°C

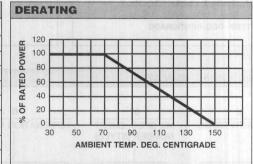


STANDARD E	STANDARD ELECTRICAL SPECIFICATIONS									
MODEL	RESISTANCE TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	TOLERANCE	MAXIMUM OPERATING VOLTAGE	POWER RATING @ 70°C					
TNPW-0603	± 25PPM/°C	100-33k	± 0.5%	75	.062 W					
TNPW-0603	± 50PPM/°C	10-91	± 0.5%	75	.062 W					
TNPW-0603	± 100PPM/°C	36k-100k	± 0.5%	75	.062 W					
TNPW-0805	± 25PPM/°C	100-100k	± 0.1%, 0.5%	100	.100 W					
TNPW-0805	± 50PPM/°C	10-91	± 0.5%	100	.100 W					
TNPW-1206	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.125 W					
TNPW-1206	± 25PPM/°C	22.1-48.7	± 0.5%, 1.0%	100	.125 W					
TNPW-1206	± 15PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125 W					
TNPW-1206	± 10PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125 W					
TNPW-1210	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.250 W					



MODEL	Α	В	С	D	E
TNPW-0603	.063 ± .008	.032 ± .008	.016 ± .004	.012 ± .008	.012 ± .008
	[1.60 ± .203]	[.813 ± .203]	[.406 ± .102]	[.305 ± .203]	[.305 ± .203]
TNPW-0805	.080 ± .008	.049 ± .008	.016 ± .004	.016 ± .010	.016 ± .008
	[2.03 ± .203]	[1.24 ± .203]	[.406 ± .102]	[.406 ± .254]	[.406 ± .203]
TNPW-1206	.126 ± .006	.063 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
	[3.20 ± .152]	[1.60 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]
TNPW-1210	.126 ± .006	.098 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
	[3.20 ± .152]	[2.49 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]

ENVIRONMENTAL PERFORMANCE						
MAX. △R (Typical Test Lots)						
± 0.1% Max. + .05Ω						
\pm 0.1% Max. + .05Ω						
± 0.1% Max. + .05Ω						
\pm 0.1% Max. $+$.05 Ω						
\pm 0.1% Max. + .05Ω						
\pm 0.1% Max. + .05 Ω						
230°C, 5 sec., 95% Coverage						
\pm 0.1% Max. $+$.05 Ω						



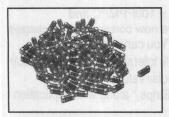
PART MARKING
TNPW-0603 and TNPW-0805 — 3 digit code (E-24 decade values)
TNPW-1206 — 4 digit code (E-96 decade values)
TNPW-1210 Contact factory.

TNPW -	1206	XXX or XXXX	В	T-9
MODEL	SIZE	VALUE	TOLERANCE	TEMPERATURE COEFFICIEN
	0603 0805 1206 1210	Digit Code: First two digits are significant figures. Last digit specifies the number of zeros to follow. Digit Code: First three digits are significant figures. Last digit specifies the number of zeros to follow.	$B = \pm 0.1\% D = \pm 0.5\% F = \pm 1.0\%$	T-1 = 100PPM/°C T-2 = 50PPM/°C T-9 = 25PPM/°C T-10 = 15PPM/°C T-13 = 10PPM/°C

MODEL SMM0204 Cylindrical Thin Film Chip Resistors

Industrial, Precision





FEATURES

- Cylindrical, leadless body style (MELF)
- Automatic placement compatibility
- Reflow and wave solderable
- Thin film resistance element
- Solderable end cap construction
- Color band marking

ENVIRONMENTAL PERFORMANCE

- 8mm tape width reel or bulk packaging
- Maximum operating voltage is 200 V
- Power rating at 70°C is 0.25 W

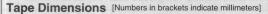
MODEL	TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	DECADE VALUES	TOLERANCE
SMM0204	± 15 PPM/°C	43-221k	E24-E192	± 0.1%
		22-221k	E24-E192	± 0.25%
		10-221k	E24-E192	± 0.5%
SMM0204	± 25PPM/°C	43-330k	E24-E192	± 0.1%
		22-330k	E24-E192	± 0.25%
		10-475k	E24-E192	± 0.5%
SMM0204	± 50PPM/°C	10-475k	E24-E192	± 0.5%
		1-2.2M	E24-E96	± 1%
SMM0204	± 100PPM/°C	1-10M	E24	± 2% & 5%
SMM0204 HF*	± 50PPM/°C	10-470	E96	± 1%

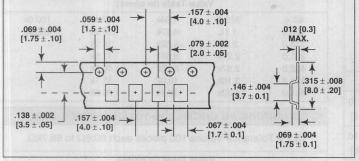
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] .020 [0.5] MIN. .020 [0.5] MIN. .004 [0.1] MAX. .059 [1.5] MAX. .142 [3.6] MAX.

TAPE AND REEL SPECIFICATIONS



SMM0204 are packed in quantities of 2,500 pieces in 180mm diameter reels. Larger reels of 10,000 pieces are available on request. The resistors are also available bulk packed in plastic boxes with styrofoam overpacking, in quantities of 1,000 or 5,000 pieces. SMM0204 in T.C.'s of 15PPM/°C or 25PPM/°C are also available in quantities of 1000 pieces on 180mm diameter reels.





DERATING

TEST

Thermal Shock

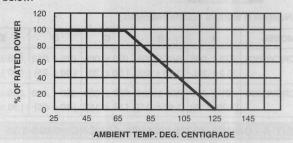
Short Time Overload

56 Day Damp Heat

Life 1,000 Hours @ 70°C

Resistance to Bonding Exposure

Dale® SMM0204 cylindrical thin film chip resistors have an operating temperature of - 55°C to + 125°C. They must be derated at high ambient temperatures according to the curve below.



PART MARKING

Depending on the tolerance, the marking consists of a four band (± 5% and \pm 2%) or five band (\pm 1% and \pm 0.1%) color code.

The color of the resistor body identifies the T.C.: Bright green = 100PPM and 50PPM. Pink = 25PPM.

Violet = 15PPM.

The HF type has a beige coating. Zero ohm resistors are bright green with a black band.

HOW TO ORDER

SMM 0204 TAPE AND REEL 332k 25 ± 0.5% MODEL SIZE VALUE T.C. TOLERANCE PACKAGING

Manufactured in Germany

MAX. AR (Typical Test Lots)

 \pm 0.10% Max. + .05Ω

 $\pm 0.10\%$ Max. + $.05\Omega$

 $\pm 0.10\%$ Max. + $.05\Omega$

 \pm 0.50% Max. + .05 Ω

 \pm 0.25% Max. + .05Ω

^{*} HF = High Frequency Version.

"THE PICK OF THE CHIPS" Thick Film Chip Resistors

Engineering Design Kit Surface Mount





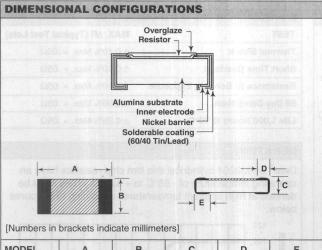
Our popular CRCW1206 and CRCW0805 - 1%, \pm 100PPM/°C and 5% \pm 200PPM/°C - Thick Film Chip Resistors are now conveniently packaged in a choice of different engineering design kits. You can choose a kit containing 74 of the most frequently specified 1% tolerance values (see value tables) or you can choose kits with 30 or 15 popular values. Each kit is packaged with components on Tape and Reel "Strips," along with application notes and technical data.

KIT 1 - ORDER # CRCW1206-101

74 1% Tolerance Values/500 pieces each. Kit 1 available in CRCW1206 size only.

	Value Table (in ohms)										
51.1	301.0	825.0	2.61k	4.75k	8.25k	22.1k	47.5k	150.0k			
60.4	332.0	1.0k	2.67k	4.87k	9.09k	24.9k	49.9k	200.0k			
80.6	402.0	1.02k	3.01k	4.99k	10.0k	26.7k	51.1k				
100.0	475.0	1.1k	3.16k	5.11k	11.5k	27.4k	56.2k				
130.0	511.0	1.5k	3.32k	5.62k	12.1k	28.0k	68.1k				
133.0	604.0	2.0k	3.48k	6.19k	14.0k	30.1k	75.0k				
178.0	619.0	2.15k	4.02k	6.81k	15.0k	31.6k	88.7k				
196.0	681.0	2.21k	4.32k	7.32k	17.4k	32.4k	90.9k				
200.0	806.0	2.49k	4.64k	7.5k	20.0k	40.2k	100.0k				

NOTE: For 100 pieces each of all 74 values, order one each of Kits 2A, 2B and 3 as shown below.



MODEL	A	В	С	D	E
CRCW0805		.049 ± .008 [1.25 ± .20]	THE RESERVE OF THE PARTY OF THE		
CRCW1206	.126 ± .006 [3.20 ± .15]		CONTRACTOR OF THE PARTY OF THE		

KIT 4 - ORD	ER #S CRCW	1206-104/	CRCW0805-104

30 5% Tolerance Values/100 pieces each 10Ω to $1M\Omega$.

Value Table (in ohms)							
10.0	220.0	820.0	4.7k	100.0k			
33.0	270.0	1.0k	5.1k	1.0M			
47.0	300.0	2.0k	10.0k				
51.0	330.0	2.2k	20.0k				
100.0	470.0	2.7k	22.0k				
150.0	510.0	3.0k	47.0k				
200.0	680.0	3.3k	68.0k				

KIT 2A - ORDER #S CRCW1206-102A/CRCW0805-102A

30 1% Tolerance Values/100 pieces each 51.1Ω to $150k\Omega$.

Value Table (in ohms)								
51.1	332.0	806.0	2.61k	4.32k	7.5k	22.1k	32.4k	150.0k
100.0	475.0	1.02k	3.01k	4.75k	9.09k	27.4k	49.9k	
133.0	511.0	1.5k	3.16k	5.11k	11.5k	30.1k	68.1k	
200.0	619.0	2.15k	3.48k	6.19k	15.0k	31.6k	90.9k	

KIT 2B - ORDER #S CRCW1206-102B/CRCW0805-102B

30 1% Tolerance Values/100 pieces each 60.4Ω to $200k\Omega$.

Value Table (in ohms)							
60.4	825.0	4.64k	17.4k	100.0k			
130.0	1.1k	4.87k	24.9k	200.0k			
178.0	2.0k	5.62k	28.0k				
301.0	2.21k	6.81k	31.6k				
402.0	2.67k	8.25k	40.2k				
511.0	3.16k	10.0k	51.1k				
681.0	4.02k	12.1k	75.0k				

KIT 3 - ORDER #S CRCW1206-103/CRCW0805-103

15 1% Tolerance Values/100 pieces each 80.6Ω to $88.7k\Omega$.

	Value Table (in ohms)									
80.6	1.0k	4.99k	14.0k	47.5k						
196.0	2.49k	7.32k	20.0k	56.2k						
604.0	3.32k	10.0k	26.7k	88.7k						

KIT 5 - ORDER #S CRCW1206-105/CRCW0805-105

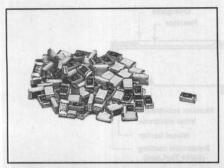
15.5% Tolerance Values/100 pieces each 330 to 100k0

Value Table (in ohms)								
33.0	300.0	820.0	2.7k	5.1k				
47.0	470.0	1.0k	3.0k	10.0k				
100.0	510.0	2.0k	4.7k	100.0k				

MODEL CRCW0603 Thick Film Chip Resistors

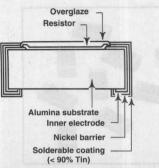
Industrial





FEATURES

- · Internationally standardized size
- · Automatic placement compatibility
- Flow solderable
- · Inner electrode protection
- · Thick film resistance element
- · Wraparound termination
- Standard resistance values = E-24
- Operating temperature range is
 55°C to + 125°C



ELECTRICAL SPECIFICATIONS

Maximum RCWV: 50 V. Rated continuous working voltage (RCWV) shall be determined from RCWV = The square root of Rated Power x Resistance Value or from maximum RCWV (50 V) whichever is less.

Resistance Range: 10 ohm to 1 Megohm.

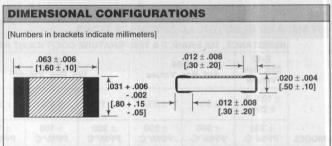
Resistance Tolerance: 1%, 5%.

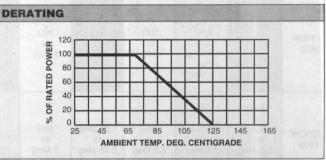
Power Rating at 70°C: 1/16 watt.

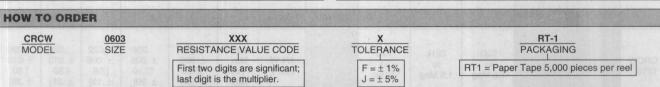
Maximum Overload Voltage: 100 V.

Dielectric Withstanding Voltage: 200 V.

ENVIRONMENTAL PERFORMANCE						
TEST	REQUIREMENT	SPECIFICATION				
Thermal Shock	$\pm (1.0\% + .05\Omega)$	EIA STD.IS-30				
Short Time Overload	$\pm (2.0\% + 0.1\Omega)$	EIA STD.IS-30				
Low Temperature Operation	$\pm (1.5\% + 0.1\Omega)$	EIA STD.IS-30				
High Temperature Exposure	$\pm (1.5\% + 0.1\Omega)$	EIA STD.IS-30				
Moisture Resistance	$\pm (1.0\% + .05\Omega)$	EIA STD.IS-30				
Life	$\pm (3.0\% + 0.1\Omega)$	EIA STD.IS-30				
Effect of Soldering	$\pm (1.0\% + .05\Omega)$	EIA STD.IS-30				
Solderability & Leach Resistance	95% min. coverage	EIA STD.IS-30				
Termination Adhesion	0.5 Kg min.	AXIAL PULL				
TC of R	± 200PPM/°C	EIA STD.IS-30				

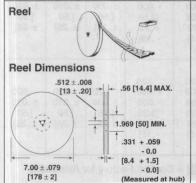


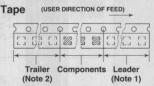




TAPE AND REEL SPECIFICATIONS

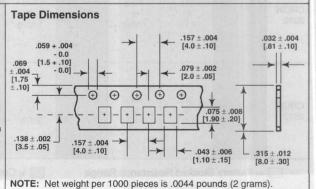
Marking: All required marking to be on unit package. Individual part marking is 3 digit value code. Packaging: 8mm Reel - 5,000 pieces per reel per EIA Std. RS-481.





NOTE 1. There shall be a leader of 230mm minimum which may consist of carrier and/or cover tape followed by a minimum of 160mm of carrier tape with sealed cover tape not to exceed 560mm combined total.

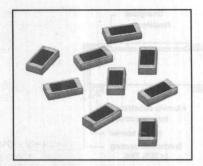
NOTE 2. There shall be a minimum of 40 empty component pockets sealed with cover tape.



MODEL CRCW Thick Film Chip Resistors

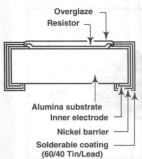
Industrial





FEATURES

- Internationally standardized size
- · Automatic placement compatibility
- Flow solderable
- Thick film resistance element
- Wraparound termination
- Inner electrode protection
- Operating temperature range is
 55°C to + 150°C



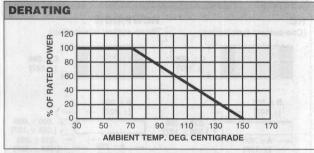
STANI	RESISTANCE, TOLERANCE & TEMPERATURE COEFFICIENT RANGE Power					Local Indiana	DIMENSIONAL CONFIGURATIONS					ONS	
	E-12 Std. Res. Values	E-24 Std. Res. Values		THIL	E-96 Std. Res. Values			10 July 10	— A	→ 			→ D ← C
	± 10% & ± 20%	± 5%	± 5%	± 1%	± 1%	± .5%	Operating Voltage (@ 70°C) (See	Zero				nce T ot leting :	eslata Trawo
MODEL	± 300 PPM/°C	± 300 PPM/°C	± 200 PPM/°C	± 200 PPM/°C	± 100 PPM/°C	± 100 PPM/°C	derating curve)	Ohm Jumper	[Numbers in	brackets ind	c c	eters]	E
CRCW 0805		5.1Ω to 9.1Ω and 1.1 Meg to 5 Meg	10Ω to 1 Meg		10Ω to 1 Meg		1/10 W 100 V	0.05Ω Max. 1 AMP Max.	.079 ± .008 [2.00 ± .20]	.049 ±.008 [1.25 ±.20]	.020 ±.008 [.50 ±.20]	.016 ±.010 [.40 ±.25]	.016 ±.010 [.40 ±.25]
CRCW 1206	3.3Ω to 8.2Ω and 2.7 Meg to 22 Meg	3Ω to 9.1Ω and 2.4 Meg to 22 Meg	10Ω to 2.2 Meg	1.01 Meg to 2.15 Meg	10Ω to 1 Meg	1k to 5k	1/8 W 200 V	0.05Ω Max. 2 AMP Max.	.126 ± .006 [3.20 ± .15]	.063 ±.006 [1.60 ±.15]	.022 ±.006 [.56 ±.15]	.020 ±.010 [.50 ±.25]	.020 ± .010 [.50 ± .25]
CRCW 1210			10Ω to 1.5 Meg	221k to 1.5 Meg	10Ω to 215k		1/4 W 200 V	0.05Ω Max. 4 AMP Max.	.126 ± .008 [3.20 ± .20]	.098 ± .008 [2.50 ± .20]	.022 ±.006 [.56 ±.15]	.020 ±.010 [.50 ±.25]	.020 ± .010 [.50 ± .25]
CRCW 2010		3Ω to 9.1Ω	10Ω to 1 Meg	e New York	10Ω to 1 Meg		1/2 W 200 V		.200 + .009 006 [5.08 + .23 15]	.100 + .009 006 [2.54 + .23 15]	.022 ±.006 [.56 ±.15]	.020 ±.010 [.50 ±.25]	.020 ± .010 [.50 ± .25]
CRCW 2512		3Ω to 9.1Ω	10Ω to 240k		10Ω to 237k		1 W 200 V		.250 + .009 006 [6.35 + .23 15]	.126 + .008 006 [3.20 + .20 15]	.022 ±.006 [.56 ±.15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]

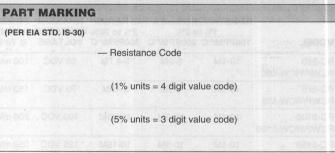
= Contact Factory for Delivery

= Contact Factory for Availability

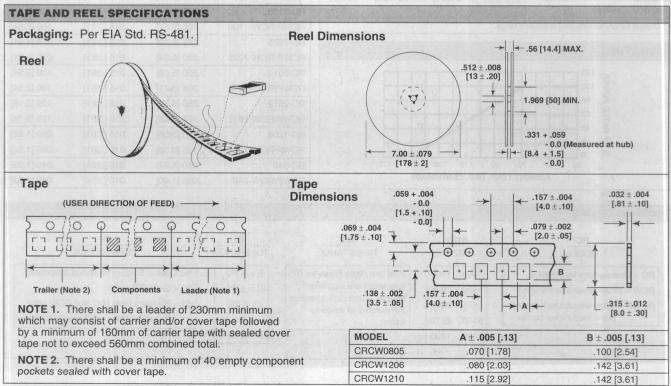
MODEL CRCW

ENVIRONMENTAL PERFORMANCE							
	REQUIR	EMENT					
TEST	1% TOLERANCE	5% TOLERANCE	SPECIFICATION				
Thermal Shock	$\pm (0.5\% + 0.05\Omega)$	$\pm (1.0\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.5				
Short Time Overload	$\pm (0.5\% + 0.05\Omega)$	$\pm (2.5\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.7				
Low Temperature Operation	$\pm (0.5\% + 0.05\Omega)$	$\pm (1.5\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.6				
High Temperature Exposure	$\pm (1.0\% + 0.05\Omega)$	$\pm (1.5\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.8				
Moisture Resistance	$\pm (0.5\% + 0.05\Omega)$	$\pm (3.0\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.10				
Life 280010018 030818-810 3004	$\pm (2.0\% + 0.05\Omega)$	$\pm (3.0\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.13				
Effect of Soldering	$\pm (0.25\% + 0.05\Omega)$	$\pm (3.0\% + 0.1\Omega)$	EIA STD.IS-30, Para. 3.9				
Solderability and Leach Resistance	95% min. coverage of termination	95% min. coverage of termination	EIA STD.IS-30, Para. 3.12				
Termination Adhesion	0.5 Kg min.	0.5 Kg min.	AXIAL PULL (soldered-on #26 nailhead lead with .037" dia. head)				





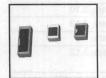
HOW TO ORDER XXXX CRCW XXX OR XXXX X XXX MODEL RESISTANCE VALUE CODE TOLERANCE SIZE PACKAGING * 0805 2010 B02 = Bulk - 1,000 pieces per plastic bag First two digits (three for "F" $F = \pm 1\%$ 1206 2512 tolerance) are significant; last RT1 = Paper Tape - 5,000 pieces per reel $J = \pm 5\%$ RT2 = Punched Plastic Tape - 5,000 pieces per reel 1210 digit is the multiplier. RT3 = Punched Plastic Tape - 10,000 pieces per reel (Contact factory) RT5 = Punched Paper Tape - 10,000 pieces per reel (Contact factory) * Contact factory for packaging on 2010 and 2512 models



MODELS RC, RCWP, RCW Thick Film Chip Resistors

Industrial



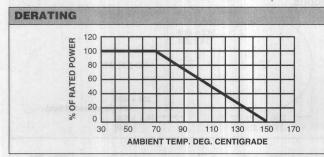


FEATURES

- Wide design flexibility for use with hybrid circuitry
- Operating temperature range: 55°C to + 150°C
- 95% minimum alumina body
- Custom sizes designed for special applications
- Termination: Solder pre-tinned electrodes standard. Gold, platinum gold or palladium silver available
- Dale has capability to develop specific reliability programs designed to customer requirements

DIMENSIONAL CONFIGURATIONS

		E (Ohms) & T	.C. RANGE* 2% to 20%	MAXIMUM OPERATING	POWER RATING
MODEL	100PPM/°C	200PPM/°C	300PPM/°C	VOLTAGE	@ 70°C
RC-550 RCWP/RCW-550	10-1M	5-2M	5-4.7M	50 VDC	100 mW
RC-575 RCWP/RCW-575	10-1M	5-5M	5-10M	70 VDC	150 mW
RC-5100 RCWP/RCW-5100	10-1M	10-5M	10-15M	100 VDC	200 mW
RC-5150 RCWP/RCW-5150	10-1M	10-5M	10-15M	125 VDC	350 mW
RC-1100 RCWP/RCW-1100	10-1M	5-5M	5-7.5M	100 VDC	400 mW
RC-7225 RCWP/RCW-7225	10-1M	10-5M	10-15M	200 VDC	600 mW
RC-2010 RCWP/RCW-2010	10-1M	10-5M	10-15M	200 VDC	800 mW
RC-2512 RCWP/RCW-2512	10-1M	10-5M	10-15M	200 VDC	1000 mW
RC-1206 RCWP/RCW-1206	10-1M	10-5M	10-10M	100 VDC	250 mW
RC-540 RCWP/RCW-540	10-1M	5-2M	5-4.7M	40 VDC	80 mW



RC (One-surface termina		CWP/RCW rap-around termination)			
	C ± .005 [± .127]		C ± .005 [± .127]		
B ± .005 [± .127] →	.020 ± .005 [.508 ± .127]	B ± .005 [± .127] →	✓ .020 ± .005 ↓ [.508 ± .127]		
A ± .005 [± .127] [Numbers in brackets inc	licata millimataval	→ A ± .005 → [± .127]	.015 ± .005 [.381 ± .127]		
MODEL	A	В	С		
RC-550	.050 [1.27]	.010 [.254]	.050 [1.27]		
RCWP/RCW-550	.055 [1.40]	.010 [.254]	.050 [1.27]		
RC-575	.075 [1.91]	.015 [.381]	.050 [1.27]		
RCWP/RCW-575	.080 [2.03]	.015 [.381]	.050 [1.27]		
RC-5100	.100 [2.54]	.015 [.381]	.050 [1.27]		
RCWP/RCW-5100	.105 [2.67]	.015 [.381]	.050 [1.27]		
RC-5150	.150 [3.81]	.015 [.381]	.050 [1.27]		
RCWP/RCW-5150	.155 [3.94]	.015 [.381]	.050 [1.27]		
RC-1100	.100 [2.54]	.015 [.381]	.100 [2.54]		
RCWP/RCW-1100	.105 [2.67]	.015 [.381]	.100 [2.54]		
RC-7225	.225 [5.72]	.015 [.381]	.075 [1.91]		
RCWP/RCW-7225	.230 [5.84]	.015 [.381]	.075 [1.91]		
RC-2010	.200 [5.08]	.015 [.381]	.100 [2.54]		
RCWP/RCW-2010	.205 [5.21]	.015 [.381]	.100 [2.54]		
RC-2512	.250 [6.35]	.015 [.381]	.125 [3.18]		
RCWP/RCW-2512	.255 [6.48]	.015 [.381]	.125 [3.18]		
RC-1206	.120 [3.05]	.015 [.381]	.060 [1.52]		
RCWP/RCW-1206	.125 [3.18]	.015 [.381]	.060 [1.52]		
RC-540	.050 [1.27]	.010 [.254]	.040 [1.02]		
RCWP/RCW-540	.055 [1.40]	.010 [.254]	.040 [1.02]		

RC -	5100	103	G	40
MODEL	SIZE	RESISTANCE	TOLERANCE	TERMINATION
RC = One-surface termination RCW = Wrap-around termination RCWP = Wrap-around termination, pre-tinned nickel barrier	540 1100 550 7225 575 2010	First two digits (three for "F" tolerance) are significant figures. Last digit specifies the number of zeros to	$F = \pm 1\%$ $G = \pm 2\%$ $J = \pm 5\%$	No Code = Solder Pre-tinned (standard) 20 = Gold (RC only) 40 = Platinum Gold (RC and RCW only)
pre-tillled flicker barrier	5100 2512 5150 1206	follow.	$K = \pm 10\%$ $M = \pm 20\%$	42 = Palladium Silver (RC and RCW only

MODELS RCM, RCWPM, RCWM Thick Film Chip Resistors

Military/Established Reliability
MIL-R-55342/2/3/4/5/6/7/8/9 Qualified, Type RM

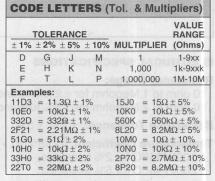


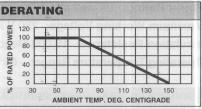


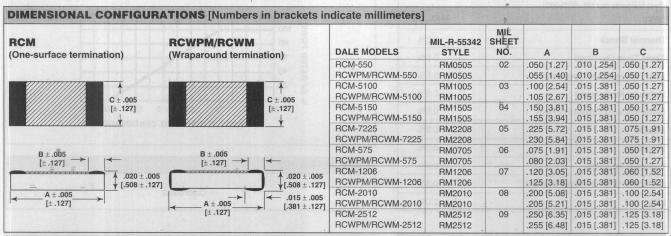
FEATURES

- · Allows wide design flexibility for use with hybrid circuitry
- Meets requirements of MIL-R-55342
- Established Reliability Verified failure rate (contact factory)
- Operating Temperature Range is 55°C to + 150°C
- 100% screen tested per Group A, Subgroup 1 of MIL-R-55342
- · Variety of termination material
- One-surface and wraparound terminations
- 95% minimum alumina body

DALE MODELS RCM, RCWPM, RCWM	MIL-R- 55342 STYLE	MIL SHEET NO.	TERMINATIONS	CHAR.	RESISTANCE RANGE (Ohms)	TOL.	MAXIMUM OPERATING VOLTAGE	POWER RATING @ 70°C
-550	RM0505	02	S, R, T, U, B, C	М	5.6-470k	10%	40	50 mW
				K, M	10-470k	2%-10%		
				K, M	10-464k	1%-10%		
-5100	RM1005	03	S, R, T, U, B, C	M	5.6-1M	10%	40	100 mW
				K, M	10-1M	1%-10%		
-5150	RM1505	04	S, R, T, U, B, C	M	5.6-4.7M	10%	40	150 mW
				M	10-4.7M	2%-10%		
				K, M	10-1M	1%-10%		
-7225	RM2008	05	S, R, B, C	М	5.6-15M	10%	40	225 mW
				M	10-15M	2%-10%		
				K, M	10-2M	1%-10%		
-575	RM0705	06	S, R, T, U, B, C	М	5.6-1M	10%	50	100 mW
				K,M	10-1M	1%-10%		
-1206	RM1206	07	S, R, T, U, B, C	M	5.6-1M	10%	100	250 mW
				K, M	10-1M	2%-10%		
				K, M	10-499k	1%-10%		
-2010	RM2010	08	S, R, T, U, B, C	M	5.6-15M	10%	150	800 mW
				M	10-7.5M	1%-10%		
				K, M	10-1M	1%-10%		
-2512	RM2512	09	S, R, T, U, B, C	M	5.6-15M	10%	200	1000 mV
				M	10-7.5M	1%-10%		
				K, M	10-1M	1%-10%		





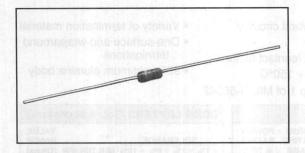




MODEL CCF-07 Metal Film Resistors

Industrial, 2% and 5% Tolerance





FEATURES

- 1/4 watt at 70°C power rating
- 2% and 5% tolerance
- 100PPM/°C and 200PPM/°C temperature coefficient
- Tape and reel packaging for automatic insertion. Meets EIA 296-E, Class I.
- Flame retardant epoxy conformal coating
- Standard 4 band color code marking for ease of identification after mounting

ELECTRICAL SPECIFICATIONS

Resistance Range:

10 ohm to 1 Megohm for \pm 2% tolerance. 10 ohm to 2 Megohm for \pm 5% tolerance.

Resistance Tolerance: $\pm 2\%$, $\pm 5\%$.

Temperature Coefficient: (- 65°C to + 150°C).

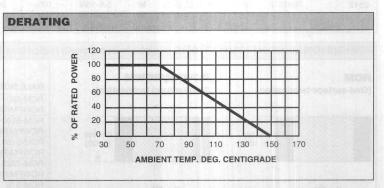
± 100PPM/°C for 2% tolerance. ± 200PPM/°C for 5% tolerance. **Power Rating:** 1/4 watt at + 70°C.

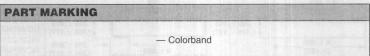
Maximum Working Voltage: 250 V RMS. **Insulation Resistance:** 10,000 Megohm.

Operating Temperature Range: -65°C to + 150°C.

DIMENSIO	NAL CONF	IGURATIO	ONS		
[Numbers in brac	kets indicate mil	limeters]		o - sooi MR	0018
201 201-25 201-25 201-21	1.10 ± .0 [27.94 ± 1	40 [6.22	± .020 ± .508]	.025 ± .002 [.635 ± .051] DIA.	
			_	and A	
			.090 ± .0 [2.29 ± .2		

ENVIRONMENTAL PERFORMA	NCE
(Test Methods per MIL-STD-202) TEST	MAX. AR
Thermal Shock	1.0%
Short Time Overload	0.5%
Low Temperature Operation	0.5%
Moisture Resistance	1.5%
Resistance to Soldering Heat	0.5%
Shock Shock	0.5%
Vibration	0.5%
Terminal Strength	0.5%
Dielectric Withstanding Voltage	0.5%
Life Life Life Life Life Life Life Life	2.0%

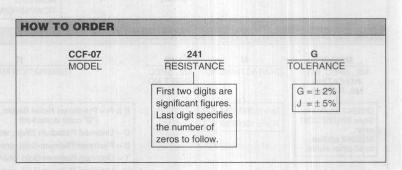




RESISTANCE VALUES

Dale® Model CCF-07 is available in the standard 24 resistance values per decade. Values are obtained from the following decade table by multiplying by powers of 10. As an example: 24 can represent 24 ohm, 240 ohm, 2.4k, 24k or 240k.

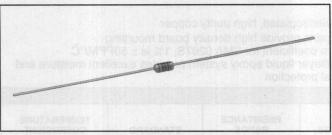
10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82 & 91.



MODELS CCF-50, CCF-55, CCF-60 Metal Film Resistors

Industrial, 1% Tolerance





ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm.

Resistance Tolerance: ± 1%.

Temperature Coefficient: (- 65°C to + 165°C) ± 100PPM/°C.

Power Rating at 70°C: CCF-50 = 1/4 watt.

CCF-55 = 1/4 watt, 1/2 watt.CCF-60 = 1/2 watt, 3/4 watt.

Maximum Working Voltage:

200 V RMS for CCF-50. 250 V RMS for CCF-55. 350 V RMS for CCF-60.

Insulation Resistance: 10,000 Megohm.

Operating Temperature Range: - 65°C to + 165°C.

ENVIRONMENTAL PERFORI	MANCE	
(Test Methods per MIL-R-202)		
POWER RATING	at 7	0°C
CCF-50	1/4 Watt	S IS FRUITOUR
CCF-55	1/4 Watt	1/2 Watt
CCF-60	1/2 Watt	3/4 Watt
TEST	MAX	. Δ R
Thermal Shock	0.5%	0.5%
Short Time Overload	0.5%	0.5%
Low Temperature Operation	0.5%	0.5%
Moisture Resistance	1.5%	1.5%
Resistance to Soldering Heat	0.5%	0.5%
Shock	0.5%	0.5%
Vibration	0.5%	0.5%
Life	1.0%	1.0%
Terminal Strength	0.2%	0.2%
Dielectric Withstanding Voltage	0.5%	0.5%

RESISTANCE VALUES

Dale® Models CCF-50, CCF-55 and CCF-60 are available in the standard 96 resistance values per decade. Values are obtained from the following decade table by multiplying by powers of 10. As an example: 30.1 can represent 30.1 ohms, 301 ohms, 3.01k, 30.1k or 301k.

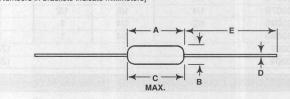
10.0, 10.2, 10.5, 10.7, 11.0, 11.3, 11.5, 11.8, 12.1, 12.4, 12.7, 13.0, 13.3, 13.7, 14.0, 14.3, 14.7, 15.0, 15.4, 15.8, 16.2, 16.5, 16.9, 17.4, 17.8, 18.2, 18.7, 19.1, 19.6, 20.0, 20.5, 21.0, 21.5, 22.1, 22.6, 23.2, 23.7, 24.3, 24.9, 25.5, 26.1, 26.7, 27.4, 28.0, 28.7, 29.4, 30.1, 30.9, 31.6, 32.4, 33.2, 34.0, 34.8, 35.7, 36.5, 37.4, 38.3, 39.2, 40.2, 41.2, 42.2, 43.2, 44.2, 45.3, 46.4, 47.5, 48.7, 49.9, 51.1, 52.3, 53.6, 54.9, 56.2, 57.6, 59.0, 60.4, 61.9, 63.4, 64.9, 66.5, 68.1, 69.8, 71.5, 73.2, 75.0, 76.8, 78.7, 80.6, 82.5, 84.5, 86.6, 88.7, 90.9, 93.1, 95.3, 97.6.

FEATURES

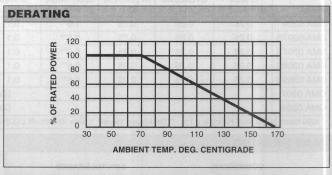
- Power Ratings: 1/4 and 1/2
 Standard 5 band color watt at 70°C
 code marking for ease
- 100PPM/°C temperature coefficient
- Superior electrical performance
- Flame retardant epoxy conformal coating
- Standard 5 band color code marking for ease of identification after mounting
- Tape and reel packaging for automatic insertion.
 Meets EIA 296-E, Class I.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

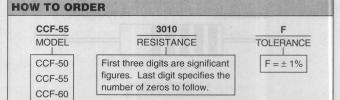


MODEL	Α	В	(Max.)	D	E
CCF-50	$.133 \pm .010$ [3.38 $\pm .254$]	.062 ± .004 [1.57 ± .102]	.143 [3.63]	$.020 \pm .002$ [.508 $\pm .051$]	1.125 ± .040 [28.58 ± 1.02]
CCF-55	$.245 \pm .020$ [6.22 $\pm .508$]	$.090 \pm .008$ [2.29 \pm .203]	.265 [6.73]	$.025 \pm .002$ [.635 $\pm .051$]	1.10 ± .040 [27.94 ± 1.02]
CCF-60	.344 ± .031 [8.74 ± .787]	.139 ± .009 [3.53 ± .229]	.400 [10.16]	$.025 \pm .002$ [.635 $\pm .051$]	1.0 ± .040 [25.4 ± 1.02]



PART MARKING

— Color band



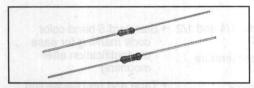
* Four Digit Figure Examples: 49R9 = 49.9 ohm, 1000 = 100 ohm, 1001 = 1k ohm, 1004 = 1 Megohm

EXAMPLE: CCF-55 3010F = Model CCF-55 metal film resistor with \pm 100PPM/°C T.C., resistance of 301 ohm and tolerance of \pm 1%

MODELS SMA and OMA Metal Film Resistors

Semi-Precision, Zero Ohm Jumpers (OMA)

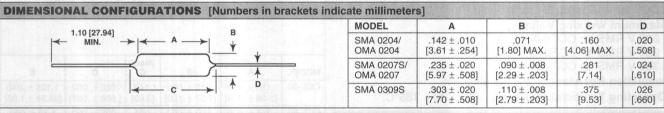




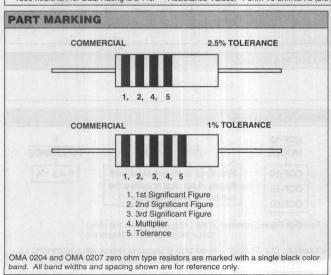
FEATURES

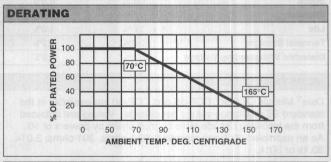
- · Leads are electroplated, high purity copper
- Dual rated parts provide high density board mounting
- Temperature coefficient for SMA 0207S, 1% is ± 50PPM/°C
- Green, multilayer liquid epoxy system provides excellent moisture and mechanical protection

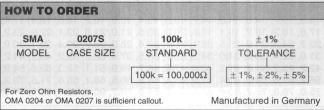
	WATT	AGE RATING	. La chratas	amelE(w)			
	STANDARD	DUAL		VOLTAGE	RESISTANCE RANGE	STANDARD	TEMPERATURE
MODEL	70°C	125°C	70°C	RATING	(Ohms)	TOLERANCE	PPM/°C
SMA 0204	1/8	1/10	1/2	200	1-1M	1, 5%	100
SMA 0207S	1/4	1/8	1/2	300	1-5.1M	1%	50
SMA 0207S	1/4	1/8	1/2	300	1-5.1M	2, 5%	100
SMA 0309S	1/2	1/4	1	350	1-2.21M	1%	100
SMA 0309S	1/2	1/4	1	350	1-5.1M	2, 5%	100
OMA 0207				(Zero Ohm Ju	imper)		
OMA 0204			(Zero Ohm Jumper)				



ENVIRON	INVIRONMENTAL PERFORMANCE									
MODEL	THERMAL SHOCK △R MAX. ± %	SHORT TIME OVERLOAD ΔR MAX. ± %	LOW TEMP. OPERATION ΔR MAX. ± %	$\begin{array}{c} \text{MOISTURE} \\ \text{RESISTANCE} \\ \Delta \text{R MAX.} \pm \% \end{array}$	SHOCK Δ R MAX. \pm %	VIBRATION Δ R MAX. \pm %	LOAD LIFE 1000 HOURS STANDARD RATING ΔR MAX. ± %	TERMINAL STRENGTH △R MAX. ± %	D. W. V. ∆R MAX. ± %	EFFECT SOLDER HEAT AR MAX. ± %
SMA 0204	0.25	0.25	0.25	1.0	0.1	0.1	0.5*	0.1	0.1	0.1
SMA 0207S	0.25	0.25	0.25	0.5**	0.1	0.1	0.5*	0.1	0.1	0.1
SMA 0207S	0.25	0.25	0.25	0.5**	0.1	0.1	0.5*	0.1	0.1	0.1
SMA 0309S	0.25	0.25	0.25	0.5**	0.1	0.1	0.5*	0.1	0.1	0.1
SMA 0309S	0.25	0.25	0.25	0.5**	0.1	0.1	0.5*	0.1	0.1	0.1
OMA 0207		(Zero Ohm Jumper)								
OMA 0204		(Zero Ohm Jumper)								



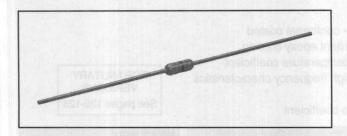




MODELS FRJ-50 and FRJ-55 Metal Film Resistors

Industrial, Jumper Resistor





FEATURES

- Provides low resistance circuit interconnections
- Color band marking for ease of identification after mounting
- · Flame retardant coating
- · Compatible with automatic insertion equipment
- · Tape and reel packaging

ELECTRICAL SPECIFICATIONS

Resistance: 0.01 ohm maximum.

Dielectric Strength: Atmospheric 500 V RMS;

reduced 325 V RMS.

Insulation Resistance: Dry 10,000 Megohm;

wet 100 Megohm.

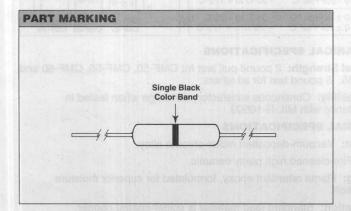
Current Rating: 25 amps at 25°C, derating to 0 amps

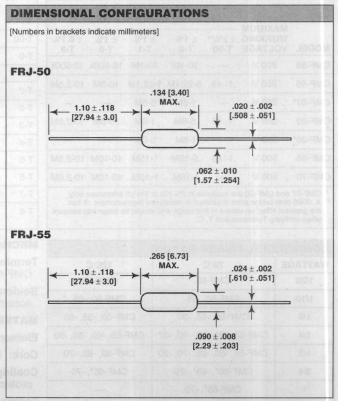
at 150°C.

Insulation Flammability: Self extinguishing 10 seconds

after flame is removed.

Lead Material: Tin-plated copper (maximum 98% tin).



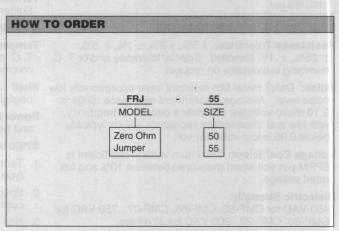


PACKAGING

Taped Lead and Reel Package per EIA 296-E Class I.

NOTES

- 1. Quantity per reel: 5,000 pieces in 5,000-piece increments.
- A minimum of 12.0" [304.80] bare tape leader shall be provided at each end of the reel.
- 3. Paper separator protection between layers of components.
- 4. Reel arbor hole is 1.25" [31.75].



MODEL	VOLTAGE	T-00	T-0	T-1	± 170 T-2	± 0.1% T-9
CMF-50	200 V		10-1M	10-1M	10-500k	10-500k
CMF-55	250 V	.149	.5-22.1M	1-22.1M	10-5M	10-2.5M
CMF-07*	250 V		1-5M	5-5M		
CMF-60	350 V	.149	.5-8M	1-8M	10-8M	10-2.5M
CMF-20*	350 V		1-8M	5-8M	100	
CMF-65	500 V	.149	.5-15M	1-15M	10-10M	10-2.5M
CMF-70	500 V	PRODUCT S	1-15M	1-15M	10-10M	10-2.5M
		1 1 1				

ſ	* CMF-07 and CMF-20 are available in 2% (G) or 5% (J) tolerances only.
	** A .0005 ohm bridge error is allowed in resistance measurement. It has
۱	the greatest effect on values in this range and should be taken into account
	when verifying Tolerance and T. C.

WATTAGE	70°C	125°C
1/20	CMF-50	CMF-50
1/10	CMF-50, -55	CMF-50, -55
1/8	CMF-50, -55, -60	CMF-50, -55, -60
1/4	CMF-55, -60, -65, -70, -07	CMF-55, -60, -65, -70
1/2	CMF-55, -60, -65, -70, -20	CMF-60, -65, -70
3/4	CMF-60*, -65*, -70	CMF-65*, -70
1	CMF-65*, -70	

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 5%, \pm 2%, \pm 1%, \pm .5%, \pm .25%, \pm .1% standard. Special tolerance and/or T. C. matching is available on request.

Noise: Dale® metal film resistors have exceptionally low noise level. Average for standard resistance range is 0.10 micro-volts per volt over a decade of frequency, with low and intermediate resistance values typically below 0.05 micro-volts per volt.

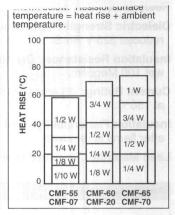
Voltage Coefficient: Maximum voltage coefficient is 5PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength:

450 VAC for CMF-50, CMF-55, CMF-07. 750 VAC for CMF-60, CMF-20. 900 VAC for all others.

Insulation Resistance: 10,000 Megohm minimum dry, 100 Megohm minimum after moisture test.

T-2 0±50PPM/°C -55°C to +175°C T-9 0±25PPM/°C -55°C to +175°C T-3 0+100PPM/°C -55°C to +175°C T-4 0-100PPM/°C -55°C to +175°C T-5 0±25PPM/°C +25°C to +145°C T-6 0+50PPM/°C -55°C to +175°C T-7 0-50PPM/°C -55°C to +175°C			
T-1 0±100PPM/°C -55°C to +175°C T-2 0±50PPM/°C -55°C to +175°C T-9 0±25PPM/°C -55°C to +175°C T-3 0+100PPM/°C -55°C to +175°C T-4 0-100PPM/°C -55°C to +175°C T-5 0±25PPM/°C +25°C to +145°C T-6 0+50PPM/°C -55°C to +175°C T-7 0-50PPM/°C -55°C to +175°C T-8 0±35PPM/°C -55°C to +25°C	1-00	0 ± 200PPM/°C	- 55°C to + 175°C
T-2 0±50PPM/°C -55°C to +175°C T-9 0±25PPM/°C -55°C to +175°C T-3 0+100PPM/°C -55°C to +175°C T-4 0-100PPM/°C -55°C to +175°C T-5 0±25PPM/°C +25°C to +145°C T-6 0+50PPM/°C -55°C to +175°C T-7 0-50PPM/°C -55°C to +175°C T-8 0±35PPM/°C -55°C to +25°C	T-0	0 ± 150PPM/°C	- 55°C to + 175°C
T-9 0±25PPM/°C -55°C to +175°C T-3 0+100PPM/°C -55°C to +175°C T-4 0-100PPM/°C -55°C to +175°C T-5 0±25PPM/°C +25°C to +145°C T-6 0+50PPM/°C -55°C to +175°C T-7 0-50PPM/°C -55°C to +175°C T-8 0±35PPM/°C -55°C to +25°C	T-1	0 ± 100PPM/°C	- 55°C to + 175°C
T-3 0 + 100PPM°C - 55°C to + 175°C T-4 0 - 100PPM°C - 55°C to + 175°C T-5 0 ± 25PPM°C + 25°C to + 145°C T-6 0 + 50PPM°C - 55°C to + 175°C T-7 0 - 50PPM°C - 55°C to + 175°C T-8 0 ± 35PPM°C - 55°C to + 25°C	T-2	0 ± 50PPM/°C	- 55°C to + 175°C
T-4 0 - 100PPM/°C - 55°C to + 175°C T-5 0 ± 25PPM/°C + 25°C to + 145°C T-6 0 + 50PPM/°C - 55°C to + 175°C T-7 0 - 50PPM/°C - 55°C to + 175°C T-8 0 ± 35PPM/°C - 55°C to + 25°C	T-9	0 ± 25PPM/°C	- 55°C to + 175°C
T-5 0 ± 25PPM/°C + 25°C to + 145°C T-6 0 + 50PPM/°C - 55°C to + 175°C T-7 0 - 50PPM/°C - 55°C to + 175°C T-8 0 ± 35PPM/°C - 55°C to + 25°C	T-3	0 + 100PPM/°C	- 55°C to + 175°C
T-6 0 + 50PPM/°C - 55°C to + 175°C T-7 0 - 50PPM/°C - 55°C to + 175°C T-8 0 ± 35PPM/°C - 55°C to + 25°C	T-4	0 - 100PPM/°C	- 55°C to + 175°C
T-7 0 - 50PPM/°C - 55°C to + 175°C T-8 0 ± 35PPM/°C - 55°C to + 25°C	T-5	0 ± 25PPM/°C	+ 25°C to + 145°C
T-8 0 ± 35PPM/°C - 55°C to + 25°C	T-6	0 + 50PPM/°C	- 55°C to + 175°C
	T-7	0 - 50PPM/°C	- 55°C to + 175°C
	T-8		



MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pound pull test for CMF-50, CMF-55, CMF-60 and CMF-65. 5 pound test for all others.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS

Element: Vacuum-deposited nickel-chrome alloy.

Core: Fire-cleaned high purity ceramic.

Coating: Flame retardant epoxy, formulated for superior moisture protection.

Termination: Standard lead material is solder-coated copper. Solderable and weldable.

ENVIRONMENTAL SPECIFICATIONS

Temperature Coefficient: CMF resistors are available in 11 standard T. C. codes of which 100PPM, 50PPM and 25PPM are the most commonly required.

Shelf Life: Resistance shifts due to storage at room temperature are negligible.

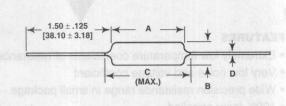
Power Rating: Power ratings are based on full power at temperatures and typical ΔR shown in the Environmental Table (1,000 hours load life).

SPECIAL MODIFICATIONS

- Terminals may be supplied in any commercial material with several type finishes.
- 2. Special pre-conditioning (power aging, temperature cycling, etc.) to customer specifications.
- Non-helixed resistors can be supplied for critical high frequency applications.
- 4. Fusible, flameproof versions available.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



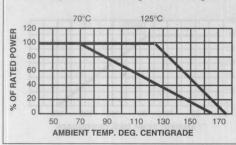
MODEL	A	В	C (Max.)	D
CMF-50	.150 ± .020 [3.81 ± .508]	.065 ± .015 [1.65 ± .381]	.244 [6.20]	$.016 \pm .002$ [.406 $\pm .051$]
CMF-55	.240 ± .020*** [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]**	$.025 \pm .002$ [.635 $\pm .051$]
CMF-60	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.025 ± .002* [.635 ± .051]
CMF-65	.562 ± .031 [14.27 ± .787]	.180 ± .015 [4.57 ± .381]	.687 [17.45]	.025 ± .002* [.635 ± .051]
CMF-70	.562 ± .031 [14.27 ± .787]	.180 ± .015 [4.57 ± .381]	.687 [17.45]	.032 ± .002 [.813 ± .051]
CMF-07	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-20	.375 ± .040 [9.53 ± 1.02]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.032 ± .002 [.813 ± .051]

^{*} Available with .032 [.813] lead. ** 290 [7.37] for \pm .25% and \pm .1% resistance tolerances and values above 1Megohm. *** .260 \pm .020 [6.60 \pm .508] for values above 5 Megohm.

	The second secon					
(Test methods per MIL-STD-202)	POWER RATING					
MODEL		AT 70°C		TIATING.	AT 125°C	
CMF-50	1/10 Watt	1/8 Watt	VÀ - MINATER	1/20 Watt	1/10 Watt	1/8 Watt
CMF-55	1/8 Watt	1/4 Watt	1/2 Watt	1/10 Watt	1/8 Watt	1/4 Watt
CMF-60	1/4 Watt	1/2 Watt	3/4 Watt	1/8 Watt	1/4 Watt	1/2 Watt
CMF-65	1/2 Watt	3/4 Watt	SIO0 1-02	1/4 Watt	1/2 Watt	ry death _ Te
CMF-70	1/2 Watt	3/4 Watt	1 Watt	1/4 Watt	1/2 Watt	3/4 Watt
CMF-07		1/4 Watt	- 111-22	-	_	tribute as
CMF-20		1/2 Watt	-	_		_
TEST			MAX. △R (T	ypical Test Lots)		
Short Time Overload	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%
Low Temperature Operation	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%
Moisture Resistance	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%	± 0.05%
Shock	± 0.01%	± 0.01%	± 0.01%	± 0.01%	± 0.01%	± 0.01%
Vibration	± 0.04%	± 0.04%	± 0.04%	± 0.04%	± 0.04%	± 0.04%
Temperature Cycling	± 0.15%	± 0.15%	± 0.15%	± 0.15%	± 0.15%	± 0.15%
Load Life	± 0.15%	± 0.5%	± 1.0%	± 0.15%	± 0.5%	± 1.0%
Dielectric Withstanding Voltage	± 0.01%	± 0.01%	± 0.01%	± 0.01%	± 0.01%	± 0.01%
Effect of Solder	± 0.03%	± 0.03%	± 0.03%	± 0.03%	± 0.03%	± 0.03%

DERATING

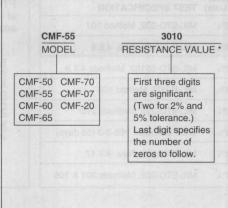
CMF resistors have an operating temperature range of - 65° C to + 175° C. They must be derated at high ambient temperatures according to the derating curve.



PART MARKING

- Dale
- ValueTolerance and T. C.
- Date code

HOW TO ORDER



* Examples: R27 = 0.27 ohm, 49R9 = 49.9 ohm, 1000 = 100 ohm, 1001 = 1 kilohm, 1004 = 1 Megohm, R511 = 0.511 ohm.

F TOLERANCE T

B = ± .1% C = ± .25% D = ± .5% F = ± 1% G = ± 2% J = ± 5%

(CMF-07 and CMF-20 available only in 2% and 5% tolerances.)

T-1 TEMPERATURE COEFFICIENT

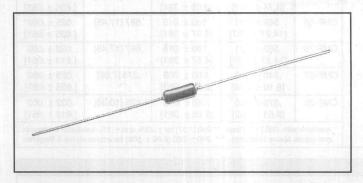
 $T-00 = \pm 200PPM/^{\circ}C$ $T-0 = \pm 150PPM/^{\circ}C$ $T-1 = \pm 100PPM/^{\circ}C$ $T-2 = \pm 50PPM/^{\circ}C$ $T-9 = \pm 25PPM/^{\circ}C$

(Tolerances of \pm 0.5% (D), \pm 0.25% (C) and \pm 0.10% (B) are available only in T-2 and T-9 temperature coefficients.)

MODEL PTF Metal Film Resistors

Industrial, Precision
Low T.C. - Tight Tolerance

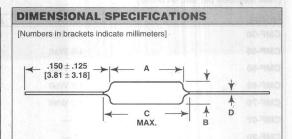




FEATURES

- Extremely low temperature coefficients of resistance
- Very low noise and voltage coefficient
- · Wide precision resistance range in small package
- 100% laser spiralled
- · Very good high frequency characteristics
- · Acceptance testing available
- · Can replace wirewound bobbins
- Proprietary epoxy coating provides superior moisture protection

STANDARD ELECTRICAL SPECIFICATIONS						
MODEL	85°C RATING	MAXIMUM WEIGHT (Grams)	MAXIMUM WORKING VOLTAGE	RESISTANCE RANGE (Ohms)	AVAILABLE TOLERANCE RANGE	
PTF-51	1/20 W	.11	200	50-100k	± 1% to ± 0.02%	
PTF-56	1/8 W	.35	300	50-500k	± 1% to ± 0.01%	
PTF-65	1/4 W	.75	500	50-1M	± 1% to ± 0.05%	



MODEL	A	В	(Max.)	D
PTF-51	.150 ± .020 [3.81 ± .508]	.070 ± .010 [1.78 ± .254]	.200 [5.08]	.016 [.406]
PTF-56	.250 + .031046 [6.35 + .787 -1.17]	.091 ± .009 [2.31 ± .229]	.300 [7.62]	.025 [.635]
PTF-65	.375 ± .062	.145 ± .016	.475	.025

MATERIAL SPECIFICATIONS

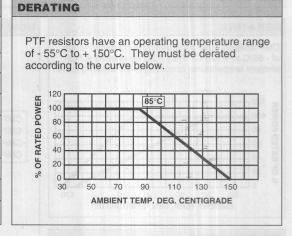
Element: Precision deposited nickel-chrome alloy with controlled annealing.

Core: Fire-cleaned high purity ceramic.

Encapsulant: Specially formulated epoxy compounds. Coated

Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

ENVIRONMENTAL PERFORMANCE				
TEST DESCRIPTION	MAX. ∆R (Typical Test Lots)	TEST SPECIFICATION		
Thermal Shock (- 55°C to + 85°C)	.02%	MIL-STD-202, Method 107		
Short Time Overload	.01%	MIL-R-10509, Para. 4.6.6		
Low Temperature Operation	.02%	MIL-STD-55182, Methods 4.7.9		
Moisture	.08%	MIL-R-202, Method 106		
Resistance to Soldering Heat	.02%	MIL-STD-202, Methods 210		
Damp Heat	.08%	IEC Publication #68-2-3 (56 days)		
Life (1000 hours rated power @ 85°C)	.04%	MIL-R-55182, Para. 4.7.17		
Dielectric Withstanding Voltage	.01%	MIL-STD-202, Methods 301 & 105		

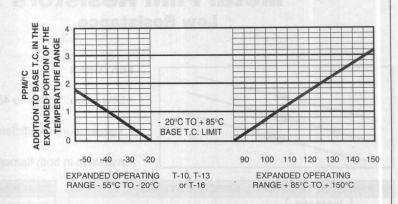


TEMPERATURE COEFFICIENT OF RESISTANCE

Temperature coefficient (T.C.) of resistance is normally stated as the maximum amount of resistance change from the original 25°C value as the ambient temperature increases or decreases. This is most commonly expressed in parts per million per degree centigrade (PPM/°C).

The resistance curve over the operating temperature range is usually a non-linear curve within predictable maximum limits. PTF resistors have a very uniform resistance temperature characteristic when measured over the operating range of - 20° C to + 85° C. The standard temperature coefficients available are T-10=±15PPM/°C, T-13 = ± $10PPM/^{\circ}$ C and T-16 = ± $5PPM/^{\circ}$ C.

Some applications of the PTF require operation beyond the specifications of - 20°C to + 85°C. The change in temperature coefficient of resistance is very small (less than 0.05PPM/°C) over the expanded temperature range of - 55°C to + 150°C. Therefore, when operating outside the range of - 20°C to + 85°C, the designer can plan for a worst case addition of 0.05PPM/°C for each degree C beyond either - 20°C or + 85°C as indicated in the graph. This applies to all three temperature coefficient codes.



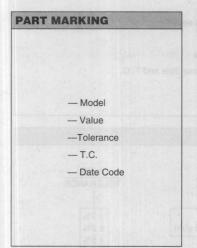
EXAMPLE: Assume the operating characteristics demand a temperature range from - 55°C to + 125°C. This requires a 35°C Δ below - 20°C and a 40°C Δ above + 85°C. The extreme Δ being 40°C means that the worst case addition to the specified T.C. limit of \pm 0.05PPM/°C times 40°C or 2PPM/°C. Therefore, a T-16 which is characterized by a base T.C. limit of \pm 5PPM/°C over the temperature range of - 20°C to + 85°C will exhibit a maximum temperature coefficient of \pm 7PPM/°C over the expanded portion of the temperature range of - 55°C to + 125°C.

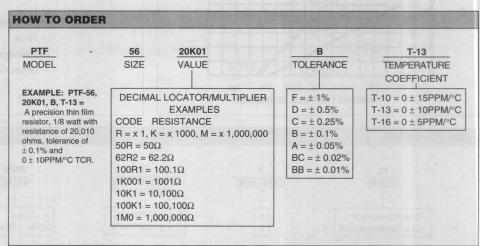
MATCHED SETS - NETWORKS

Dale's® many years of experience in matching resistors for sets and networks, combined with the superb performance of the PTF product, provide the best and most economical solution to your precision resistor requirements. Why? Because most applications for precision resistors depend on two or more discretes having an initial tolerance ratio and a resistance tracking capability over temperature rather than each discrete resistor meeting the absolute requirements of the application.

Cost savings approaching 50% can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistors to have more relaxed specifications.

Dale® application engineers are available to assist you in specifying your requirements in the most economical way possible.

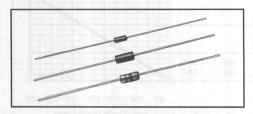




MODELS FL and LO Metal Film Resistors

Low Resistance



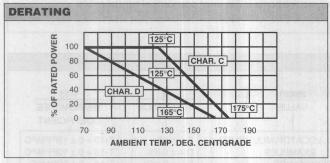


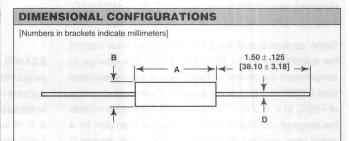
FEATURES

- Low value: 1 ohm to 48.7 ohm
- Temperature Coefficient as low as ± 50PPM/°C
- Available in both flameproof (FL) and nonflameproof (LO) construction

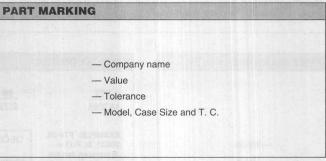
STAND	ARD	ELEC.	TRICAL SPE	CIFICATION	S
MODEL	WATTAGE RATING		RESISTANCE	STANDARD*	TEMPERATURE
	70°C	125°C	(Ohms)	TOLERANCE	PPM/°C
FL4C	1/2	1/4	1-48.7	1, 2, 5%	50
FL5C	1	1/2	1-48.7	1, 2, 5%	50
FL4D	1/2	1/4	1-9.98	1, 2, 5%	100
FL5D	1	1/2	1-9.98	1, 2, 5%	100
LO4C	1/2	1/4	1-48.7	1, 2, 5%	50
LO5C	1	1/2	1-48.7	1, 2, 5%	50
LO4D	1/2	1/4	1-9.98	1, 2, 5%	100
LO5D	1	1/2	1-9.98	1, 2, 5%	100

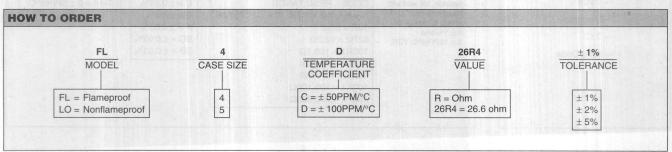
ENVIRONMENTAL PERFORM	ANCE
TEST	MAX. ∆R (Typical Test Lots)
Thermal Shock	± 0.25%
Short Time Overload	± 0.25%
Low Temperature Operation	± 0.25%
Moisture Resistance	± 1.0%
Shock	± 0.1%
Vibration	± 0.1%
Load Life (1000 hours MIL Rating)	± 0.5%
Terminal Strength	± 0.1%
Effect Solder Heat	± 0.25%
Dielectric Withstanding Voltage	± 0.1%





MODEL	Α	В	D
FL4C	.235 + .020 [5.97 ± .508] 025635]	.088 ± .010 [2.24 ± .254]	.025 [.635]
FL5C	.350 ± .030 [8.89 ± .762]	.130 + .015 [3.30 + .381] 025635]	.032 [.813]
FL4D	.235 + .020 [5.97 ± .508] 025635]	.088 ± .010 [2.24 ± .254]	.025 [.635]
FL5D	$.350 \pm .030 [8.89 \pm .762]$.130 + .015 [3.30 + .381] 025635]	.032 [.813]
LO4C	.235 ± .020 [5.97 ± .508]	.090 ± .008 [2.29 ± .203]	.025 [.635]
LO5C	$.355 \pm .020 [9.02 \pm .508]$.148 + .000 [3.76 + .000] 023584]	.032 [.813]
LO4D	.235 ± .020 [5.97 ± .508]	.090 ± .008 [2.29 ± .203]	.025 [.635]
LO5D	.355 ± .020 [9.02 ± .508]	.148 + .000 [3.76 + .000] 023584]	.032 [.813]

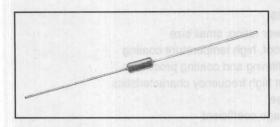




MODEL CMH-55-100 Metal Film Resistors

Industrial, High Value





FEATURES

- 1/4 watt at 70°C power rating
- \pm 0.5%, \pm 1%, \pm 2% tolerance
- · Non decade values available
- Tape and reel packaging for automatic insertion available.
 Meets EIA 296-E.
- Flame retardant epoxy conformal coating
- Small dimensional size to value ratio
- 50PPM/°C and 100PPM/°C temperature coefficient

ELECTRICAL SPECIFICATIONS

Resistance Range: 5.01 Megohm thru 15 Megohm.

Resistance Tolerance:

5.01 Megohm - 10 Megohm = \pm 0.5%, \pm 1%, \pm 2%.

10.1 Megohm - 15 Megohm = \pm 1%, \pm 2%.

Temperature Coefficient: (- 20°C to + 125°C) 5.01 Megohm - 10 Megohm = 0 ± 50PPM°C,

0 ± 100PPM°C.

10.1 Megohm - 15 Megohm = 0 ± 100 PPM°C.

Power Rating: Limited by maximum working voltage.

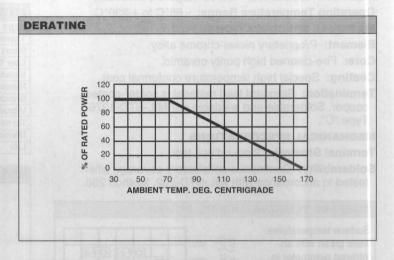
Maximum Working Voltage: 250 V RMS.

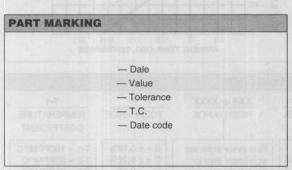
Insulation Resistance: 10,000 Megohm, minimum.

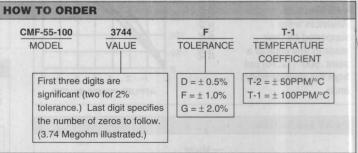
Operating Temperature Range: -65°C to + 165°C.

[Numbers in	brackets indicate mi	illimeters]		
*	- 1.50 ± .125 [38.10 ± 3.18] -	.240 ± .020 [6.10 ± .508]	.025 ± .020 [.635 ± .508]	9.99 2.799 2.799
	6, 5%.	.290 [7.37]	.090 ± .008 [2.29 ± .203]	ECTR seister

(Test Methods per MIL-STD-202)	MAX. △R (Typ	ical Test Lots)
TEST	5M to 10M	10M to 15M
Thermal Shock	.10%	.10%
Short Time Overload (500 V maximum, 10 seconds)	.25%	.25%
Low Temperature Operation	.10%	.10%
Moisture Resistance (no load or polar over 10M)	.10%	1.0%
Resistance to Soldering Heat	.10%	.10%
Shock	.10%	.10%
Vibration	.05%	.05%
Load Life 1,000 Hours @ 125°C	.50%	2.0%
Terminal Strength	.10%	.10%
Dielectric Withstanding Voltage	.05%	.05%



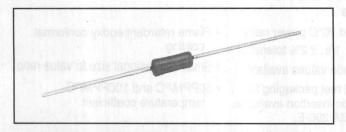




MODEL CPF Metal Film Resistors

Industrial, Power, Flameproof





MODEL	WATTAGE RATING 70°C	VOLTAGE RATING	RESISTANCE RANGE 1% AND ABOVE (Ohms)
CPF-1	1	250	0.1-150k
CPF-2	2	350	0.1-150k
CPF-3	3	500	0.1-150k

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: .1%, .25%, .5%, 1%, 5%. **Temperature Coefficient:** $(-55^{\circ}\text{C to} + 125^{\circ}\text{C}) \pm 100\text{PPM/}^{\circ}\text{C}, \pm 50\text{PPM/}^{\circ}\text{C}, \pm 25\text{PPM/}^{\circ}\text{C}$.

Dielectric Strength: 900 VAC.

Insulation Resistance: 10,000 Megohm, minimum.

Operating Temperature Range: -65°C to + 230°C.

MATERIAL SPECIFICATIONS

Element: Proprietary nickel-chrome alloy. **Core:** Fire-cleaned high purity ceramic.

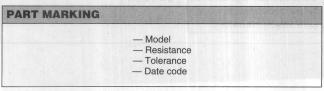
Coating: Special high temperature conformal coat. **Termination:** Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type "C".

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pound pull test.

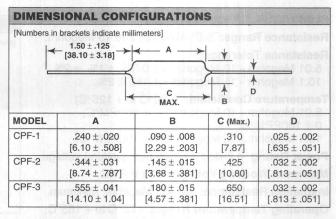
Solderability: Continuous satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

Surface temperatures were taken with an infrared pyrometer in + 25°C still air. Resistors were supported by their leads in test clips at a point .500" [12.70] out	SURFACE TEMP. (°C) ABOVE AMBIENT (°C)	250 - 200 - 150 - 100 - 50 -	CPF	CPF-	2 CPF	-3
from the resistor body ends.		0	1 APPL	2 3	4 5 VER (WA	6 7

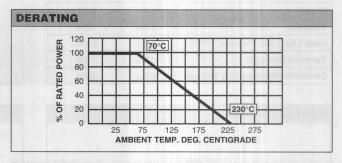


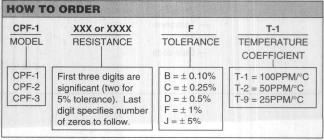
FEATURES

- · High power rating, small size
- · Flameproof, high temperature coating
- · Special filming and coating processes
- Excellent high frequency characteristics
- Low noise
- · Low voltage coefficient



TEST	MAX. △R (Typical Test Lots)
Thermal Shock	± 1.0%
Short Time Overload	± .5%
Low Temperature Operation	± .5%
Moisture Resistance	± 1.5%
Resistance To Soldering Heat	± .5%
Shock	± .5%
Vibration	± .5%
Terminal Strength	± .5%
Dielectric Withstanding Voltage	± .5%
Life	± 2.0%

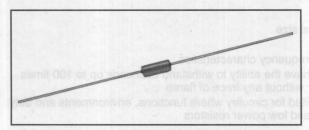




MODELS FP55E, 60E, 55C, 60C, 55D Metal Film Resistors

Precision, Flameproof

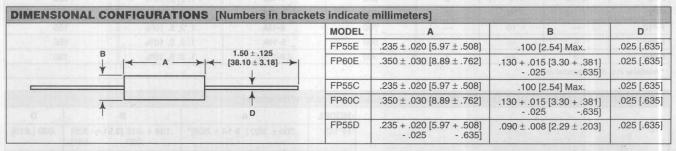




FEATURES

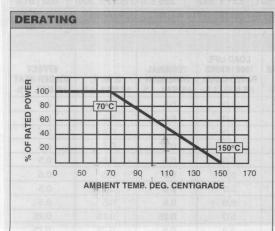
- Flameproof coating
- · Ideal for circuits where high power overloads may be encountered
- Tolerances down to .1%
- Temperature Coefficient: ± 25PPM/°C, ± 50PPM/°C
- Leads are electroplated, high purity copper
- Meets IEC-695-2-2 requirements for flammability
- 96% alumina substrate has superior thermal properties which reduce hot spot temperatures and long-term aging effects

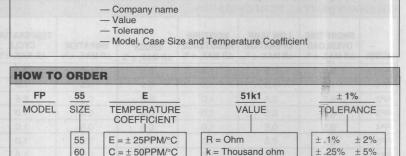
STANDARD ELECTRICAL SPECIFICATIONS							
MODEL	WATTAGE RATING 70°C	VOLTAGE RATING	RESISTANCE RANGE (Ohms)	STANDARD TOLERANCE	TEMPERATURE COEFFICIENT PPM/°C		
FP55E	1/4	200	49.9-499k	.1, .25, .5, 1%	25		
FP60E	1/2	250	49.9-1M	.1, .25, .5, 1%	25		
FP55C	1/4	200	49.9-499k	.1, .25, .5, 1%	50		
FP60C	1/2	250	49.9-1M	.1, .25, .5, 1%	50		
FP55D	1/4	250	10-499k	1, 2, 5%	100		



ENVIR	ONMENTA	L PERFORI	MANCE							2
MODEL	THERMAL SHOCK AR MAX. ± %	SHORT TIME OVERLOAD ΔR MAX. ± %	LOW TEMP. OPERATION ΔR MAX. ± %	MOISTURE RESISTANCE AR MAX. ± %	SHOCK Δ R MAX. \pm %	VIBRATION ∆R MAX. ± %	LOAD LIFE 1000 HOURS MIL RATING ΔR MAX. ± %	TERMINAL STRENGTH ∆R MAX. ± %	D. W. V. ΔR MAX. ± %	EFFECT SOLDER HEAT AR MAX. ± %
FP55E	0.25	0.25	0.25	1.0	0.1	0.1	0.5	0.1	0.1	0.1
FP60E	0.25	0.25	0.25	1.0	0.1	0.1	0.5	0.1	0.1	0.1
FP55C	0.25	0.25	0.25	1.0	0.1	0.1	0.5	0.1	0.1	0.1
FP60C	0.25	0.25	0.25	1.0	0.1	0.1	0.5	0.1	0.1	0.1
FP55D	0.50	0.50	0.50	1.0	0.5	0.5	1.0	0.25	0.5	0.25

PART MARKING





M = Million ohm

(51k1 = 51,000 ohm)

51R1 = 51.1 ohm.)

D = ± 100PPM/°C

±.5%

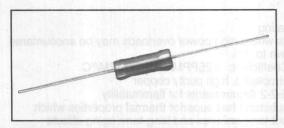
±1%

± 10%

MODEL FP Metal Film Resistors

Industrial, Flameproof

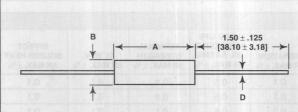




FEATURES

- Small physical size
- Low cost
- Exceptional frequency characteristics
- FP resistors have the ability to withstand overloads up to 100 times rated power without any trace of flame
- Especially suited for circuitry where functions, environments and duty cycles demand low power resistors

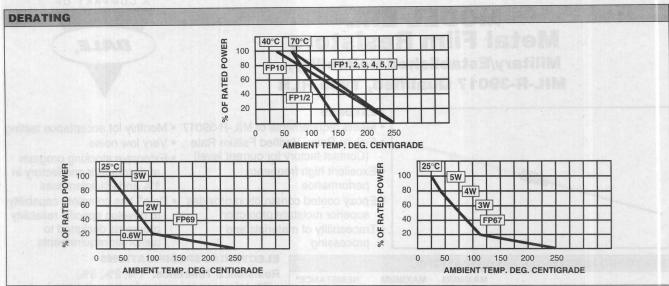
MODEL	WATTAGE RATING			VOLTAGE	RESISTANCE RANGE	STANDARD*	TEMPERATURE
	25°C	40°C	70°C	RATING	(Ohms)	TOLERANCE	PPM/°C
FP1/2			1/2	350	10-1M	1, 2, 5, 10%	150
FP1			1 -	500	10-1M	1, 2, 5, 10%	150
FP2	3 1/2	3	2	500	9-1.5M	1, 2, 5, 10%	150
FP3	4	4	3	500	9-1M	1, 2, 5, 10%	150
FP4	5 1/2	5	4	500	6-1M	1, 2, 5, 10%	150
FP5	6 1/2	6	5	600	7-1M	1, 2, 5, 10%	150
FP7	7 1/2		7	700	8-1M	1, 2, 5, 10%	150
FP10	- T	10	-	700	8-1M	1, 2, 5, 10%	150
FP67	5		0.00 1 0 0 1 10	500	5-19k	1, 2, 5, 10%	150
FP69	3		2	500	2.6-1.5M	1, 2, 5, 10%	150

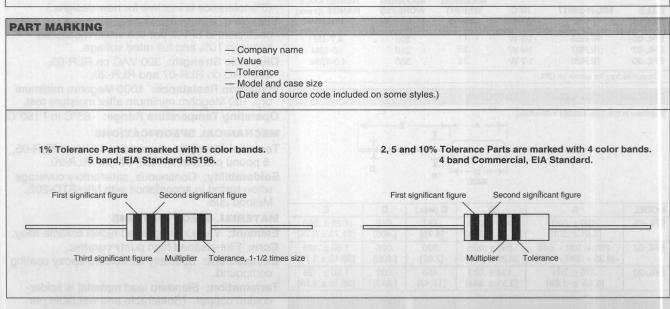


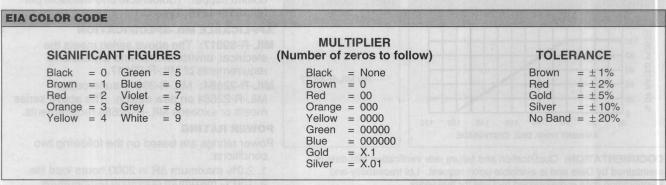
MODEL	A	В	D
FP1/2	.360 ± .020 [9.14 ± .508]*	.138 + .012 [3.51 + .305] 023584]	.032 [.813]
FP1	.560 ± .031 [14.22 ± .787]	.190 + .007 [4.83 + .178] 015381]	.032 [.813]
FP2	.687 ± .031 [17.45 ± .787]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP3	.900 ± .031 [22.86 ± .787]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP4	1.53 ± .035 [38.86 ± .889]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP5	1.71 ± .035 [43.43 ± .889]	$.300 \pm .020 [7.62 \pm .508]$.032 [.813]
FP7	2.04 ± .035 [51.82 ± .889]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP10	2.04 ± .035 [51.82 ± .889]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP67	.900 ± .031 [22.86 ± .787]	.300 ± .020 [7.62 ± .508]	.032 [.813]
FP69	.516 ± .021 [13.11 ± .533]	.225 ± .012 [5.72 ± .305]	.032 [.813]

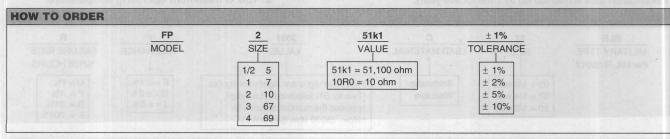
ENVI	RONMENTA	AL PERFOR	RMANCE							
MODEL	SHORT TIME OVERLOAD AR MAX. ±%	LOW TEMP. OPERATION △R MAX. ± %	MOISTURE RESISTANCE Δ R MAX. \pm %	SHOCK Δ R MAX. ± %	VIBRATION ∆R MAX. ± %	TEMPERATURE CYCLE AR MAX. ± %	LOAD LIFE 1000 HOURS RATED COND. ΔR MAX. ± %	TERMINAL STRENGTH △R MAX. ± %	D. W. V. △R MAX. ± %	EFFECT SOLDER HEAT △R MAX. ± %
FP1/2	0.5	0.5	1.0	0.5	0.5	1.0	1.0	0.5	0.5	0.5
FP1	1.0	0.5	1.5	0.5	0.5	1.0	2.0	0.5	0.5	0.5
FP2	0.5	0.5	1.0	0.5	0.5	0.5	5.0	0.5	0.5	0.5
FP3	0.5	0.5	1.0	0.5	0.5	1.0	5.0	0.5	0.5	0.5
FP4	0.5	0.5	1.0	0.5	0.5	1.0	5.0	0.5	0.5	0.5
FP5	0.5	0.5	1.0	0.5	0.5	1.0	5.0	0.5	0.5	0.5
FP7	0.5	0.5	1.0	0.5	0.5	1.0	5.0	0.5	0.5	0.5
FP10	0.5	0.5	1.0	0.5	0.5	1.0	5.0	0.5	0.5	0.5
FP67	0.5	0.25	1.0	0.5	0.5	1.0	5.0	0.25	0.25	0.25
FP69	0.5	0.25	1.0	0.5	0.5	0.5	3.0	0.5	0.25	0.25

MODEL FP





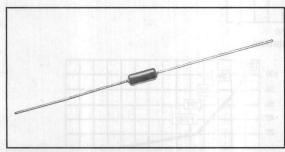




MODEL ERL Metal Film Resistors

Military/Established Reliability, MIL-R-39017 Qualified, Type RLR





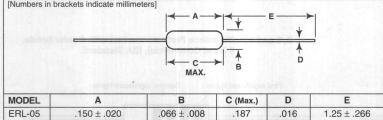
FEATURES

- Meets requirements of MIL-R-39017
 Monthly lot acceptance testing
- Failure Rate: Verified Failure Rate
 Very low noise (Contact factory for current level)
- Excellent high frequency performance
- Epoxy coated construction provides Dale® has complete capability superior moisture protection
- Traceability of materials and processing

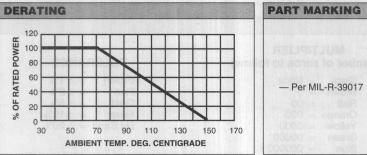
- Extensive stocking program at distributors and factory in 1% and 2% tolerances
- to develop specific reliability programs designed to customer requirements

DALE MODEL	MIL-R-39017 TYPE	70°C RATING	MAXIMUM WEIGHT (Grams)	MAXIMUM WORKING VOLTAGE	RESISTANCE RANGE (Ohms) T-1 (100PPM)
ERL-05	RLR05	1/8 W	.11	200	4.7-1M
ERL-07	RLR07	1/4 W	.35	250	10-10M
ERL-20	RLR20	1/2 W	.75	350	4.3-155k

* Consult factory for values on QPL **DIMENSIONAL CONFIGURATIONS** [Numbers in brackets indicate millimeters]



MODEL		integrated and reduced and a	O (INICA.)		
ERL-05	.150 ± .020	.066 ± .008	.187	.016	1.25 ± .266
	[3.81 ± .508]	[1.68 ± .203]	[4.75]	[.406]	[31.75 ± 6.76]
ERL-07	.250 + .031046	.090 ± .008	.300	.025	1.50 ± .125
	[6.35 + .787 - 1.17]	[2.29 ± .203]	[7.62]	[.635]	[38.10 ± 3.18]
ERL-20	.375 ± .041	.138 ± .023	.450	.032	1.50 ± .125
	[9.53 ± 1.04]	[3.51 ± .584]	[11.43]	[.813]	[38.10 ± 3.18]



DOCUMENTATION: Qualification and failure rate verification test data is maintained by Dale and is available upon request. Lot traceability and identification data is maintained by Dale for five years.

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 1%, 2%, 5%. (5% tolerance is inactive for new designs.)

Voltage Coefficient: Maximum voltage coefficient is 5PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength: 300 VAC on RLR-05, 500 VAC on RLR-07 and RLR-20.

Insulation Resistance: 1000 Megohm minimum dry, 100 Megohm minimum after moisture test. Operating Temperature Range: -65°C to +150°C.

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pound pull test on RLR-05, 5 pound pull test on RLR-07 and RLR-20.

Solderability: Continuous, satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

MATERIAL SPECIFICATIONS

Element: Vacuum-deposited nickel chrome alloy.

Core: Fire-cleaned high purity ceramic.

Encapsulant: Specially formulated epoxy coating compound.

Termination: Standard lead material is soldercoated copper. (Solderable and weldable per MIL-STD-1276, Type C.)

APPLICABLE MIL-SPECIFICATION

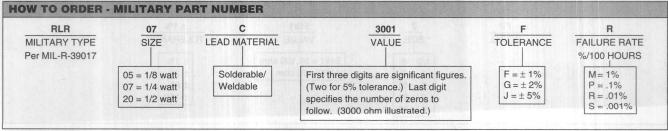
MIL-R-39017: The above series meets the electrical, environmental and dimensional requirements of MIL-R-39017.

MIL-R-22684: MIL-R-39017 supercedes MIL-R-22684 on new design. The above series meets or exceeds MIL-R-22684 requirements.

POWER RATING

Power ratings are based on the following two conditions:

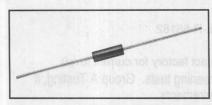
- 1. 2.0% maximum ΔR in 2000 hours load life.
- 2. 150°C maximum operating temperature.



MODEL HN Metal Film Resistors



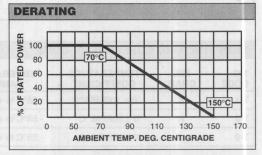


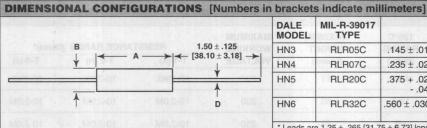


FEATURES

- "S" level failure rate
- High purity copper leads in accordance with MIL-STD-1276. Two solder finishes are available, electroplated 60/40 solder and hot dipped 60/40 solder.
- Blue epoxy insulation over polyimide varnish provides superior moisture resistance properties

STANDARD ELECTRICAL SPECIFICATIONS									
DALE MODEL	MIL-R-39017 TYPE	WATTAGE RATING 70°C	VOLTAGE RATING	RESISTANCE RANGE (Ohms)	STANDARD * TOLERANCE	TEMPERATURE COEFFICIENT PPM/°C			
низ	RLR05C	1/8	200	4.7-300k	1, 2, 5%	100			
HN4	RLR07C	1/4	250	10-1M	1, 2, 5%	100			
HN5	RLR20C	1/2	350	10-1M	1, 2, 5%	100			
HN6	RLR32C	ns efolud	500	10-1M	1, 2, 5%	100			





DALE MODEL	MIL-R-39017 TYPE	over A sec	В	D
HN3	RLR05C	.145 ± .015 [3.68 ± .381]	.066 ± .008 [1.68 ± .203]	.016 [.406]*
HN4	RLR07C	.235 ± .020 [5.97 ± .508]	.090 ± .008 [2.29 ± .203]	.025 [.635]
HN5	RLR20C	.375 + .025 [9.53 + .635] 040 - 1.02]	.135 + .020 [3.43 + .508] 005127]	.032 [.813]
HN6	RLR32C	.560 ± .030 [14.22 ± .762]	.190 + .007 [4.83 + .178] 015381]	.040 [1.02]

ENVI	INVIRONMENTAL PERFORMANCE											
DALE MODEL	MIL-R-39017 TYPE	POWER CONDITIONING AR MAX. ± %	THERMAL SHOCK △R MAX. ± %	SHORT TIME OVERLOAD ΔR MAX. \pm %	LOW TEMP. STORAGE ΔR MAX. \pm %	LOW TEMP. OPERATION ΔR MAX. \pm %	MOISTURE RESISTANCE ΔR MAX. ± %		LOAD LIFE 2000 HOURS MIL RATING △R MAX. ± %	TERMINAL STRENGTH △R MAX. ± %	D. W. V. ΔR MAX. ± %	EFFECT SOLDER HEAT Δ R MAX. ± %
HN3	RLR05C	0.50	0.25	0.50	0.10	0.10	0.50	0.05	1.0	0.05	0.05	0.10
HN4	RLR07C	0.50	0.25	0.50	0.10	0.10	0.50	0.05	1.0	0.05	0.05	0.10
HN5	RLR20C	0.50	0.25	0.25	0.10	0.10	0.50	0.05	1.0	0.05	0.05	0.10
HN6	RLR32C	0.50	0.25	0.25	0.25	0.25	0.50	0.10	2.0	0.10	0.10	0.10

PART MARKING

RLR05

- Year, week of year, lot code
- Coded resistance value' Tolerance, FR, JAN,
- manufacturer symbol

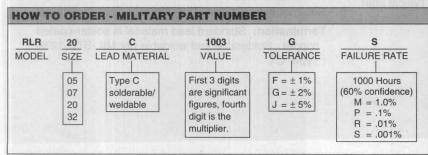
RLR07

- Year, week of year, lot code, JAN
- Model, lead material
- Coded resistance value*, tolerance
- FR, manufacturer symbol

RLR20 & RLR32

- Year, week of year, lot code, JAN
- Model, lead material
- Coded resistance value*, tolerance, FR
- Source code
- Company name

^{* ± 5%} tolerance parts are marked with 3 digit resistance value code, e.g. 103. ± 2% tolerance parts are marked with 4 digit code but may be special ordered with 3 digit code. All \pm 5% parts and \pm 2% parts with 3 digit coding are inactive for new design.



HOW TO ORDER - DALE MODEL									
HN	3	1003	± 1%						
MODEL	SIZE	VALUE	TOLERANCE						
	3	First 3 digits	± 1%						
	4	are significant	± 2%						
	5	figures, fourth	± 5%						
	6	digit is the multiplier.							

TEMPERATURE COEFFICIENT CODE								
T.C. CODE	MIL. CHAR.	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE					
T-1	K	0 ± 100PPM/°C	- 55°C to + 175°C					
T-2	Н	0 ± 50PPM/°C	- 55°C to + 175°C					
T-9	aure Jason	0 ± 25PPM/°C	- 55°C to + 175°C					

	-		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	iariot	
Ероху	coating	provides	superior	moisture	protection

- Standard lead on RNC product is solderable and weldable
- Traceability of materials and processing
- · Monthly acceptance testing
- Dale[®] has complete capability to develop specific reliability programs designed to customer requirements
- Extensive stocking program at distributors and factory on RNC50, RNC55, RNC60 and RNC65

DALE	MIL-R-55182	70°C RATING	125°C RATING	MAXIMUM WEIGHT	MAXIMUM WORKING	RESIS	RESISTANCE RANGE (Ohms)*		
MODEL	TYPE	(Watts)	(Watts)	(Grams)	VOLTAGE	T-1 (K)	T-2 (H)	T-9 (J)	
ERC-50	RNC50	1/10	1/20	D098.J011	200	10-796k	10-796k	10-796k	
ERC-55	RNC55	1/8	1/10	.35	200	10-2.0M	10-2.0M	10-2.0M	
ERC-55-200	RNC60	1/4	1/8	.35	250	10-2.0M	10-2.0M	10-2.0M	
ERC-60	RNC60	1/4	1/8	.75	250	10-3.01M	10-3.01M	10-3.01M	
ERC-65	RNC65	1/2	1/4	.84	300	10-3.01M	10-3.01M	10-3.01M	
ERC-70	RNC70	3/4	1/2	1.60	350	10-3.01M	10-3.01M	10-3.01N	

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 1%, .5%, .1%.

Voltage Coefficient: Maximum voltage coefficient is 5PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength: 450 VAC on ERC-50, ERC-55 and ERC-60. 900 VAC on ERC-65 and ERC-70.

Insulation Resistance: 10,000 Megohm minimum dry, 100 Megohm minimum after moisture test. Typical after moisture test is 200,000 Megohm.

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pound pull test on ERC-50, ERC-55, ERC-60 and ERC-65. 4.5 pound pull test on ERC-70.

Solderability: Continuous, satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

MATERIAL SPECIFICATIONS

Core: Fire-cleaned high purity ceramic.

Element: Vacuum-deposited nickel-chrome alloy.

Encapsulant: Specially formulated epoxy compound.

Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276,

Type "C".

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

MODEL	ulacturing piAcess	y inneren B n the man	C (Max.)	D	E
ERC-50	.150 ± .020 [3.81 ± .508]	.070 ± .010 [1.78 ± .254]	.187 [4.75]	.016 [.406]	1.25 ± .266 [31.75 ± 6.76]
ERC-55	.250 + .031046 [6.35 + .787 - 1.17]	.091 ± .009 [2.31 ± .229]	.300 [7.62]	.025 [.635]	1.50 ± .125 [38.10 ± 3.18]
ERC-55-200	.280 ± .020 [7.11 ± .508]	.094 ± .009 [2.39 ± .229]	.350 [8.89]	.025 [.635]	1.50 ± .125 [38.10 ± 3.18]
ERC-60	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .406]	.450 [11.43]	.025 [.635]	1.50 ± .125 [38.10 ± 3.18]
ERC-65	.562 ± .031 [14.27 ± .787]	.175 ± .015 [4.45 ± .381]	.687 [17.45]	.025 [.635]	1.50 ± .125 [38.10 ± 3.18]
ERC-70	.562 ± .031 [14.27 ± .787]	.175 ± .015 [4.45 ± .381]	.687 [17.45]	.032 [.813]	1.50 ± .125 [38.10 ± 3.18]

APPLICABLE MIL-SPECIFICATIONS

MIL-R-55182: The ERC Models meet or exceed the electrical, environmental and dimensional requirements of MIL-R-55182.

MIL-R-10509: MIL-R-55182 supersedes MIL-R-10509 on new design. The ERC models meet or exceed MIL-R-10509 requirements.

DERATING Dale ERC resistors have an operating temperature range of - 65°C to + 175°C. They must be derated according to the following curve: 120 POWER 100 80 OF RATED 60 40 20 0 70 110 130 AMBIENT TEMP. DEG. CENTIGRADE

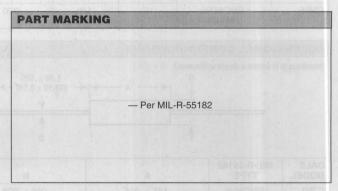
DOCUMENTATION

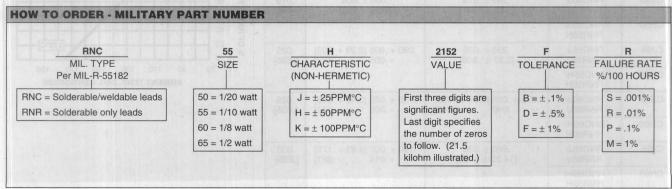
Qualification and failure rate verification test data is maintained by Dale and is available upon request. Lot traceability test data and identification data is maintained by Dale for 5 years.

POWER RATING

Dale ERC power ratings are based on the following two conditions:

- 1. 2% maximum ΔR in 10,000 hours load life.
- 2. 175°C maximum operating temperature.

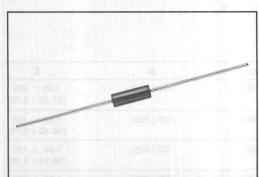




MODELS CJ and CH Metal Film Resistors





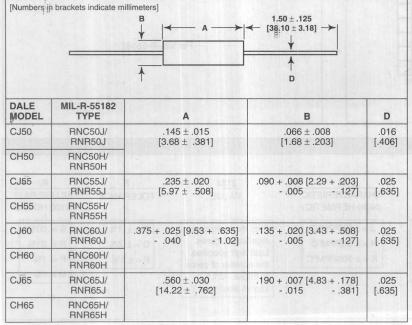


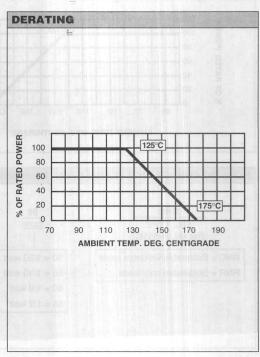
DIMENSIONAL CONFIGURATIONS

FEATURES

- FINC and RNR resistors are designed for the many military applications where established reliability is a must
- Extended life tests of over one-half billion unit test hours have proven the reliability inherent in the manufacturing process
- All CH and CJ resistors are "S" level failure rate
- These resistors are provided with high purity copper leads in accordance with MIL-STD-1276. Two solder finishes are available: Electroplated 60/40 solder and hot dipped 60/40 solder.
- Blue epoxy insulation coating over polyimide varnish provides superior moisture resistance properties
- NOTE: Users ordering characteristic K will be provided characteristic H or J in accordance with paragraph 3.27.5 of MIL-R-55182

STANDA	RD ELECTRICAL	SPECIFIC	ATIONS				
			WATTAGE RA	TING	RESISTANCE	Tree 55,201	TEMPERATURE COEFFICIENT PPM/°C
DALE MODEL	MIL-R-55182 TYPE	70°C	125°C	VOLTAGE RATING	RANGE (Ohms)	STANDARD TOLERANCE	
CJ50	RNC50J/ RNR50J	1/10	1/20	200	49.9-150k	.1, .5, 1%	25
CH50	RNC50H/ RNR50H	1/10	1/20	200	10-150k 49.9-150k	.5, 1% .1%	50
CJ55	RNC55J/ RNR55J	1/8	1/10	200	49.9-301k	.1, .5, 1%	25
CH55	RNC55H/ RNR55H	1/8	1/10	200	10-301k 49.9-301k	.5, 1% .1%	50
CJ60	RNC60J/ RNR60J	1/4	1/8	250	49.9-499k	.1, .5, 1%	25
CH60	RNC60H/ RNR60H	1/4	1/8	250	10-499k 49.9-499k	.5, 1% .1%	50
CJ65	RNC65J/ RNR65J	1/2	1/4	300	49.9-1M	.1, .5, .1%	25
CH65	RNC65H/ RNR65H	1/2	1/4	300	10-1M 49.9-1M	.5, 1% .1%	50

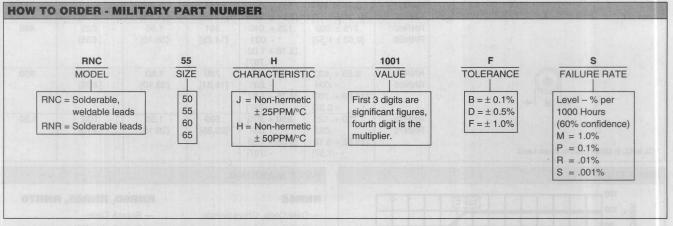


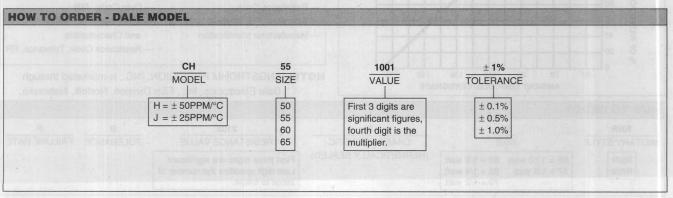


MODELS CJ and CH

ENVI	ENVIRONMENTAL PERFORMANCE										
DALE MODEL	MIL-R-55182 TYPE	OVERLOAD & THERMAL SHOCK △R MAX. ± %	LOW TEMP. OPERATION △R MAX. ± %	HIGH TEMP. EXPOSURE △R MAX. ± %	MOISTURE RESISTANCE ΔR MAX. ± %	SHOCK AR MAX. ± %	$\begin{array}{c} \text{VIBRATION} \\ \Delta \text{R MAX.} \pm \% \end{array}$	LOAD LIFE 2000 HOURS MIL RATING ΔR MAX. \pm %	TERMINAL STRENGTH △R MAX. ± %	D. W. V. ΔR MAX. ± %	EFFECT SOLDER HEAT △R MAX. ± %
CJ50	RNC50J/ RNR50J	0.2	0.15	0.5	0.4	0.2	0.2	0.5	.0.2	0.15	0.1
CH50	RNC50H/ RNR50H						aanu	FARY (TT			
CJ55	RNC55J/ RNR55J	0.2	0.1	0.5	0.4	0.05	0.05	0.5	0.05	0.1	0.1
CH55	RNC55H/ RNR55H	Highestre		0.0	námichec	voneupari	ellent bigh	oncil e			
CJ60	RNC60J/ RNR60J	0.2	0.1	0.5	0.4	0.05	0.05	0.5	0.05	0.1	0.1
CH60	RNC60H/ RNR60H	SPECIFIC Ierunce:	STRICAL stance To	esa EE							
CJ65	RNC65J/ RNR65J	0.2	0.1	0.5	0.4	0.05	0.05	0.5	0.05	0.1	0.1
CH65	RNC65H/ RNR65H	034'0 = 0 8310 = 3	lary Code tan/Code			LDF	200	801	PAR S	2867	авункант н

PART MA	ARKING	Mesonios de la como dela como de la como de	
	RNC55	RNC60 & RNC65	RNC50
	— Date Code, Characteristic	— Source Code	— Date Code, Characteristic
	— Style and Terminal	— Date Code and JAN	— Value
	— Value	— Style, Terminal, (60/65)	— Tolerance, FR, Terminal, JAN
	Tolerance, FR, Terminal, JAN, Manufacturer Symbol	and Characteristic — Value, Tolerance and FR	— Lot Code, Manufacturer Symbol
		— Production Lot Code	

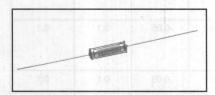




MODELS HN, HS, HT, HY Metal Film Resistors



Military/Established Reliability, MIL-R-55182 Qualified Type RNR and RNN, Hermetically Sealed



FEATURES

- Qualified to MIL-R-55182 Characteristics C and E
- Performance exceeds requirements of MIL-R-55182
- · Excellent high frequency performance
- Hermetic glass enclosure is impervious to harmful environments
- Inert gas filled
- · Very low noise
- Highest reliability
- · Excellent long term stability

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: 1.0%, Code F. 0.5%, Code D. 0.1%, Code B.

Temperature Coefficient:

Military Code C = 0 ± 50 PPM/°C. Military Code E = 0 ± 25 PPM/°C.

Failure Rate: M = 1.0%. P = 0.1%.

R = 0.01%. S = 0.001%.

Operating Temperature Range: - 65°C to + 175°C. (See Derating Curve.)

MECHANICAL SPECIFICATIONS

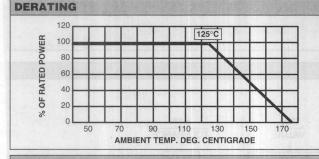
Termination:

RNR = Solderable leads.

RNN = Weldable Leads.

ANGSTROHM	MIL-R-55182	MILITARY POWER RATING		MAXIMUM WORKING	QUALIFIED RESISTANCE RANGE (Ohms)	
MODEL	TYPE	125°C	70°C	VOLTAGE	MIN.	MAX.
HT/HS/HY55	RNR55	1/10	1/8	200	10.0	1.21M
HN55	RNN55					
HS/HN57	RNR57	1/8	1/4	250	49.9	200K
HN57	RNN57					
HT/HS/HN60	RNR60	1/8	1/4	250	10.0	2.49M
HN60	RNN60					
HT/HS/HY65	RNR65	1/4	1/2	300	24.9	4.99M
HN65	RNN65					
HS/HY70	RNR70	1/2	3/4	350	24.9	7.5M
HN70	RNN70					

Dimensions shown are maximum allowable per MIL-R-55182.	MILITARY	A LENGTH	B DIAMETER	C CL to CL* (Max.)	D LENGTH (± .125 [3.18])	E DIAMETER (±.002 [.051])	APPROX WEIGHT (Grams)
E C	RNR55 RNN55	.250 + .031 046 [6.35 + .787 - 1.17]	.109 ± .031 [2.77 ± .787]	.379 [9.63]	1.50 [38.10]	.025 [.635]	.314
$A \longrightarrow A \longrightarrow A$	RNR57 RNN57	.281 ± .062 [7.14 ± 1.57]	.155 ± .015	.467 [11.86]	1.25 [31.75]	.020 [.508]	.317
	RNR60 RNN60	.375 ± .062 [9.53 ± 1.57]	.125 + .040 031 [3.18 + 1.02 787]	.561 [14.25]	1.50 [38.10]	.025 [.635]	.485
(a) B ←	RNR65 RNN65	6.25 + .031 094 [15.88 + .787 - 2.39]	.188 + .062 031 [4.78 + 1.57 787]	.780 [19.81]	1.50 [38.10]	.025 [.635]	.950
CL to CL is Clean Lead to Clean Lead.	RNR70 RNN70	.750 + .125 062 [19.05 + 3.18 - 1.57]	.250 + .078 031 [6.35 + 1.98 787]	.939 [23.85]	1.50 [38.10]	.032 [.813]	1.30



RNR55 — Date Code, Characteristic — Resistance Code — Tolerance, FR, Terminal, JAN — Manufacturer Identification RNR60, RNR65, RNR70 — Source Code — Date Code, JAN — Style, Terminal, (60/65/70) and Characteristic — Resistance Code, Tolerance, FR

NOTE: ANGSTROHM PRECISION, INC., is marketed through Dale Electronics, Inc., Film Division, Norfolk, Nebraska.

RNR MILITARY STYLE	_ <u>55</u> SIZE	CHARACTERISTIC	2152 RESISTANCE VALUE	B TOLERANCE	R FAILURE RATE
RNR	55 = 1/10 watt 60 = 1/8 watt 57 = 1/8 watt 65 = 1/4 watt 70 = 1/2 watt	(HERMETICALLY SEALED)	First three digits are significant. Last digit specifies the number of zeros to follow.		

MODEL SMH Metal Film Resistors

Industrial, Hermetically Sealed Surface Mountable, MELF Resistors



250

2.49M

10



FEATURES

- Although not Military Qualified, the SMH is designed to meet the electrical performance of MIL-R-10509 and MIL-R-55182
- Excellent long term stability and high frequency performance
- · Hermetically sealed construction
- Very low noise

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 2.49 Megohm.

Resistance Tolerance: $\pm .05\%$, $\pm .1\%$, $\pm .25\%$, $\pm .5\%$, $\pm .1\%$.

Temperature Coefficient: ± 25PPM/°C, ± 50PPM/°C, ± 100PPM/°C.

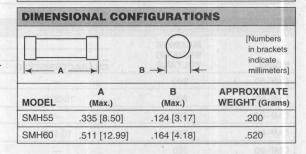
Contact factory for special TCRs. **Power Rating:** 1/5, 1/4 watt at 70°C. **Voltage Coefficient:** 5PPM/V maximum.

Dielectric Strength: 450 VAC.

Insulation Resistance: 50,000 Megohm (minimum).

rs			MARK TO	
STAND	ARD EL	ECTRIC	AL SPECIFI	CATIONS
	POWER RATING (Watts)		MAXIMUM WORKING	RESISTANCE RANGE (Ohms)
MODEL	70°C	125°C	VOLTAGE	(Min.) (Max.)
SMH55	1/5	1/10	200	10 1.21M

1/8



THE ANGSTROHM FAMILY Of Metal Film Resistive Products

Resistors - Hermetically Sealed and Conformal Coated Resistor Networks - High Precision



	1
\$60.4 \$10 (180.3 \$90) \$60.2 \$50 (180.3 \$00) \$60.2 \$50 (180.3 \$00) \$60.3 \$00.5 \$1	
**************************************	1 1 1 1

MODELS H55, H57, H60, H65, H70 Metal Film Resistors

Excellent High Frequency Performance and a Hermetic Glass Enclosure which is Impervious to Harmful Environments

MODELS C50, C55, C60, C65, C70 Metal Film Resistors

Excellent High Frequency Performance, Excellent Long Term Stability and a very Low Noise Level

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 7.5 Megohm. Resistance Tolerance: Tolerances to \pm 0.05%. Special TCRs, contact factory. Power Rating: 1/10 watt thru 1/2 watt.

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 7.5 Megohm. Resistance Tolerance: Tolerances to \pm 0.05%. Special TCRs, contact factory. Power Rating: 1/20 watt thru 1/2 watt.

RESISTOR NETWORKS

SMH60

1/4

Angstrohm's high precision resistor networks provide design engineers with the flexibility to package several resistors in a small space while maintaining tight resistance ratio matching, close tolerance coefficient of resistance tracking and minimum temperature gradients between resistors. Models are available in a wide variety of body styles and ranges.

MATCHED SETS

Angstrohm offers matched sets which provide an economical method of achieving a resistive matching in a critical circuit without resorting to networks. Angstrohm hermetic or non-hermetic discrete metal film resistors (2 - 20 or more) are matched to the customer's exacting specifications. The matched set is supplied in a single package. Resistance Values: 10Ω to $7.5M\Omega$. Resistance Tolerances: $\pm .05\%$ to 1.0%. Resistance Match: .01% to 1.0%. T. C.: $\pm 25PPM/^{\circ}C$. Contact factory for complete details.

IMPROVED PERFORMANCE TESTING

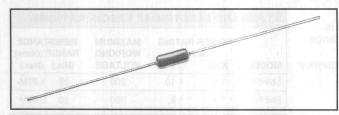
Angstrohm metal film resistors are designed and manufactured to the most demanding quality standards and highest reliability levels possible. Our resistors are used in military aircraft, missiles and aerospace programs which demand the most exacting specifications and highest levels of reliability. Angstrohm has the facilities and capabilities to supply product to these specifications by employing **improved performance testing**. Contact factory for complete details.

ANGSTROHM Precision, Inc., is marketed through Dale Electronics, Inc., Film Division, Norfolk, Nebraska.

MODEL CMF **Metal Film Resistors**







FEATURES

- Very low noise
- Very low voltage coefficient
- Controlled temperature coefficient
- · Excellent high frequency characteristics
- · Flame retardant epoxy coating

	MAXIMUM		DALE MILITARY APPROVED VA	ALUE RANGE (Ohms)	
	WORKING		MIL-R-10509	And the second s	MIL-R-22684
MODEL	VOLTAGE	CHARACTERISTIC D	CHARACTERISTIC C	CHARACTERISTIC E	en annamadal
CMF-50	200		10-100k	10-100k	Valender Jermine
CMF-55	200	10-301k	49.9-100k	49.9-100k	
CMF-07	250	MAHME!			51-150k
CMF-60	300	10-1M	49.9-499k	49.9-499k	
CMF-20	350			<u> </u>	4.3-470k
CMF-65	350	10-2M	49.9-1M	49.9-1M	
CMF-70	500	10-2.49M	24.9-1M	24.9-1M	

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test for CMF-07 and CMF-20; 2 pound pull test for all others.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509 and MIL-R-22684

MATERIAL SPECIFICATIONS

Core: Fire-cleaned high purity ceramic.

Element: Nickel-chrome alloy.

Coating: Flame retardant epoxy, formulated for superior

moisture protection.

Termination: Standard lead material is solder-coated

copper, solderable and weldable.

ENVIRONMENTAL SPECIFICATIONS

General: Environmental performance is shown in the table below. Test methods are those specified in

MIL-R-10509 and MIL-R-22684.

Shelf Life: Resistance shifts due to storage at room temperature are negligible.

APPLICABLE MIL-SPECIFICATIONS

MIL-R-10509 and MIL-R-22684: The CMF models meet or exceed the electrical, environmental and dimensional requirements of MIL-R-10509 and MIL-R-22684.

Noise: Dale® metal film resistors have exceptionally low noise level. Average for standard resistance range is 0.10 micro-volt per volt over a decade of frequency, with low and intermediate resistance values typically below 0.05 micro-volt per volt.

Voltage Coefficient: Maximum voltage coefficient is 5PPM per volt when measured between 10% and full rated voltage.

Dielectric Strength:

450 VAC for CMF-50, CMF-55 and CMF-60.

500 VAC for CMF-07.

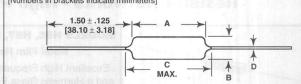
700 VAC for CMF-20.

900 VAC for CMF-65 and CMF-70.

Insulation Resistance: 10,000 Megohm minimum dry;

100 Megohm minimum after moisture test.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



MODEL	A	В	C (Max.)	D
CMF-50	.150 ± .020 [3.81 ± .508]	.065 ± .015 [1.65 ± .381]	.244 [6.20]	.016 ± .002 [.406 ± .051]
CMF-55	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]*	.025 ± .002 [.635 ± .051]
CMF-60	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.025 ± .002 [.635 ± .051]
CMF-65	.562 ± .031 [14.27 ± .787]	.180 ± .015 [4.57 ± .381]	.687 [17.45]	.025 ± .002 [.635 ± .051]
CMF-70	.562 ± .031 [14.27 ± .787]	.180 ± .015 [4.57 ± .381]	.687 [17.45]	.032 ± .002 [.813 ± .051]
CMF-07	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-20	.375 ± .040 [9.53 ± 1.02]	.145 ± .015	.425 [10.80]	.032 ± .002 [.813 ± .051]

TEMPERATURE COEFFICIENT CODE					
COMMERCIAL T.C. CODE	10509 MIL. CHAR.	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE		
T-1/ personal for	sm bri Doerick	0 ± 100PPM/°C	- 55°C to + 175°C		
T-2	С	0 ± 50PPM/°C	- 55°C to + 175°C		
T-9	efelomEs soft	0 ± 25PPM/°C	- 55°C to + 175°C		
T-00	MIL-R-22684	0 ± 200PPM/°C	- 55°C to + 150°C		

MODEL CMF

ENVIRONMENTAL PERFORMANCE MIL-R-10509 MIL-R-22684							
		MIL-R-22684					
REQUIREMENT	CHARACTERISTIC D	CHARACTERISTIC C	CHARACTERISTIC E				
BN50	CMF-50	CMF-50	CMF-50				
RN55	CMF-55	CMF-55	CMF-55				
RN60	CMF-60	CMF-60	CMF-60				
RN65	CMF-65	CMF-65	CMF-65				
RN70	CMF-70	CMF-70	CMF-70				
RL07		- 23AUT		CMF-07			
RL20		the Just well the endowner		CMF-20			
Mil. Temp. Coefficient	+ 200-500PPM	± 50PPM	± 25PPM	± 200PPM			
Applicable T.C. Code	T-1 (100PPM), T-0 (150PPM)	T-2 (50PPM)	T-9 (25PPM)	T-00 (± 200PPM			
Applicable 1.C. Code	1-1 (100FFW), 1-0 (150FFW)	1-2 (301 1 101)	1-9 (251 1 101)	1-00 (± 2001 1 101			
POWER RATING	at 70°C	at 125°C	at 125°C	at 70°C			
RN50	entenalomeno	1/20 Watt	1/20 Watt				
RN55	1/8 Watt	1/10 Watt	1/10 Watt				
RN60	1/4 Watt	1/8 Watt	1/8 Watt				
RN65	1/2 Watt	1/4 Watt	1/4 Watt				
RN70	3/4 Watt	1/2 Watt	1/2 Watt				
RL07				1/4 Watt			
RL20		_		1/2 Watt			
TEST	MIL. MAX.	MIL. MAX.	MIL. MAX.	MIL. MAX.			
Thermal Shock	± 0.50% ΔR	± 0.25% ΔR	± 0.25% ΔR	± 1.00% ΔR			
Short Time Overload	± 0.50% ΔR	± 0.25% ΔR	± 0.25% ΔR	± 0.50% ΔR			
Low Temperature Operation	± 0.50% ΔR	± 0.25% ΔR	± 0.25% ΔR	± 0.50% ΔR			
Moisture Resistance	± 1.50% ΔR	± 0.50% ΔR	± 0.50% ΔR	± 1.50% ΔR			
Shock	± 0.50% ΔR	± 0.25% ΔR	± 0.25% ΔR	± 0.50% ΔR			
Vibration	± 0.50% ∆R	± 0.25% ΔR	± 0.25% ΔR	± 0.50% ΔR			
Load Life	± 1.00% ΔR	± 0.50% ΔR	± 0.50% ΔR	± 2.00% ΔR			
Dielectric Withstanding Voltage	ge ± 0.50% ΔR	± 0.25% ΔR	± 0.25% ΔR	± 0.50% ΔR			
Effect of Solder	± 0.50% ΔR	± 0.10% ΔR	± 0.10% ΔR	± 0.50% ΔR			

MILITARY POWER RATING							
	MILITARY QUALIFIED						
	MIL-R-	-10509	MIL-R-22684				
WATTAGE	70°C (D)	125°C (C & E)	70°C				
1/20		CMF-50 (RN50)	0t 0				
1/10		CMF-55 (RN55)					
1/8	CMF-55 (RN55)	CMF-60 (RN60)	00.				
1/4	CMF-60 (RN60)	CMF-65 (RN65)	CMF-07 (RL07)				
1/2	CMF-65 (RN65)	CMF-70 (RN70)	CMF-20 (RL20)				
3/4	CMF-70 (RN70)	_					

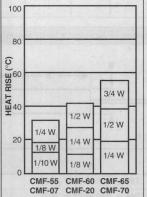
NOTE: Commercial equivalents of military styles are available with higher power ratings. Consult factory.

POWER RATING

Dale CMF resistors have two power ratings depending on operating temperatures of 70°C and 125°C. Both are based on a maximum ΔR of .5% in 1,000 hour load life.

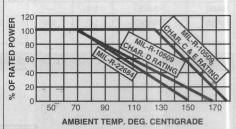
HEAT RISE

The increase in resistor surface temperature due to rated load is shown in the chart below. Resistor temperature = heat rise + ambient temperature.



DERATING

Dale CMF resistors have an operating temperature range of - 65°C to + 175°C. They must be derated according to the following curves:



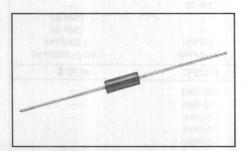
PART MARKING — RN, per MIL-R-10509 — RL, per MIL-R-22684

RN	60	D	3483	F
MIL. TYPE	SIZE	CHARACTERISTIC	VALUE	TOLERANCE
Per MIL-R-10509	50 65 55 70 60	E = ± 25PPM/°C C = ± 50PPM/°C D = + 200PPM/°C - 500PPM/°C	First three digits are significant figures. Last digit specifies the number of zeros to follow. (348 kilohm illustrated.)	$B = \pm .1\%$ $C = \pm .25\%$ $D = \pm .5\%$ $F = \pm 1\%$
RL	07	S	471	J
MIL. TYPE	SIZE	LEAD	VALUE	TOLERANCE
Per MIL-R-22684	07 20	S = Solderable	First two digits are significant figures. Last digit specifies the number of zeros to follow. (470 ohm illustrated.)	$G = \pm 2\%$ $J = \pm 5\%$

MODELS NE, NC, CT, NA Metal Film Resistors

Military, MIL-R-10509, Qualified, Type RN, Precision

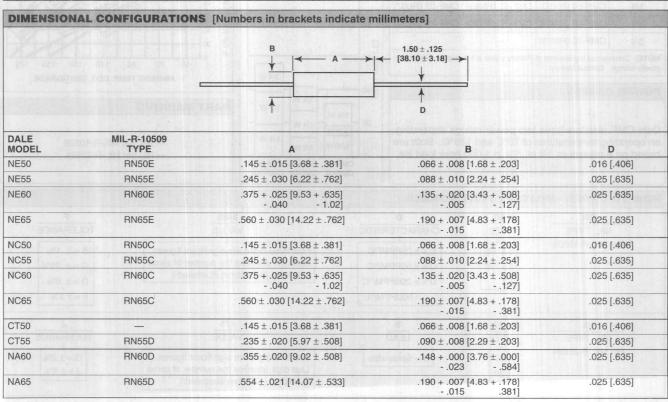




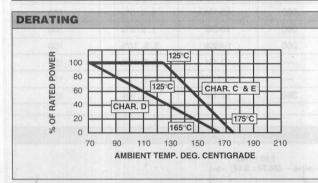
FEATURES

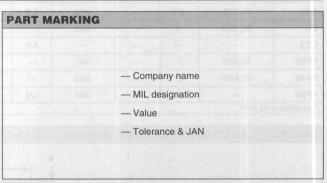
- Low noise and low inductance characteristics
- · Blue epoxy encapsulation over moisture resistant polyimide varnish undercoat
- Special marking available
- Controlled Temperature Coefficient: ± 25, ± 50 and ± 100PPM/°C
- Excellent high frequency characteristics
- Low voltage coefficient
- These resistors are provided with high purity copper leads in accordance with MIL-STD-1276. Two solder finishes are available: Electroplated 60/40 solder and hot dipped 60/40 solder.

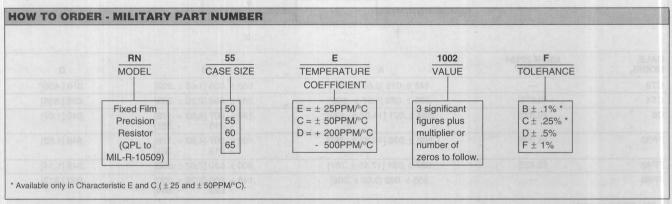
	AM ISS			WATTAG	E RATING	G		XA III		STANDED S
	-X40-1	MILITARY				INDUSTR	RIAL	RESISTANCE		TEMPERATURE
DALE MODEL	MIL-R-10509 TYPE	70°C	125°C	VOLTAGE RATING	70°C	125°C	VOLTAGE RATING	RANGE (Ohms)	STANDARD TOLERANCE	COEFFICIENT PPM/°C
NE50	RN50E	-	1/20	200	1/4	1/8	200	10-499k	.5, 1%	25
NE55	RN55E		1/10	200	1/2	1/4	250	49.9-1M	.1, .25, .5, 1%	25
NE60	RN60E		1/8	250	1	1/2	350	49.9-1.M	.1, .25, .5, 1%	25
NE65	RN65E		1/4	300	1	1/2	350	49.9-1M	.1, .25, .5, 1%	25
NC50	RN50C		1/20	200	1/4	1/8	200	10-499k	.5, 1%	50
NC55	RN55C		1/10	200	1/2	1/4	250	49.9-1M	.1, .25, .5, 1%	50
NC60	RN60C		1/8	250	1	1/2	350	49.9-1M	.1, .25, .5, 1%	50
NC65	RN65C	ter top items	1/4	300	1	1/2	350	49.9-1M	.1, .25, .5, 1%	50
CT50	old er of held	nortess had	an all ord		1/4	1/8	200	2-499k	1%	100
CT55	RN55D	1/8	N - la	200	1/2	1/4	300	10-1M	1%	100
NA60	RN60D	1/4	-	300	1100	1/2	350	10-1M	1%	100
NA65	RN65D	1/2	1/4	350	1	1/2	350	49.9-1M 10-2M	.5% 1%	100

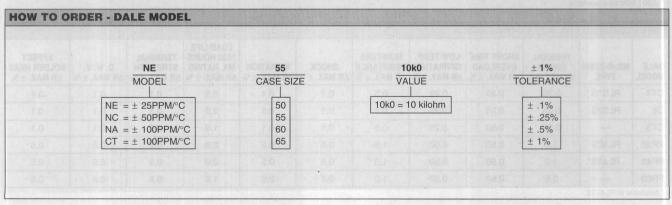


DALE MODEL	MIL-R-10509 TYPE	THERMAL SHOCK △R MAX. ±%	SHORT TIME OVERLOAD △R MAX. ± %	LOW TEMP. OPERATION △R MAX. ±%	MOISTURE RESISTANCE △R MAX. ±%	SHOCK AR MAX. ±%	$\begin{array}{c} \text{VIBRATION} \\ \Delta \text{R MAX.} \pm \% \end{array}$	LOAD LIFE 1000 HOURS MIL RATING \triangle R MAX. \pm %	TERMINAL STRENGTH △R MAX. ±%	D. W. V. \triangle R MAX. \pm %	EFFECT SOLDER HEAT △R MAX. ±%
NE50	RN50E	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NE55	RN55E	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NE60	RN60E	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NE65	RN65E	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NC50	RN50C	0.25	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NC55	RN55C	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NC60	RN60C	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NC65	RN65C	0.1	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
CT50	leverren v	0.25	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
CT55	RN55D	0.25	0.1	0.1	0.5	0.05	0.05	0.5	0.05	0.05	0.1
NA60	RN60D	0.25	0.1	0.1	0.5	0.05	0.05	0.5 1.0*	0.05	0.05	0.1
NA65	RN65D	0.25	0.1	0.1	0.5	0.05	0.05	0.5 1.0*	0.05	0.05	0.1





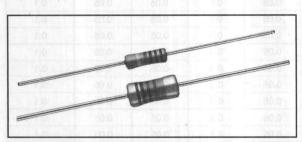




MODELS CT, C, FP Metal Film Resistors

Military, MIL-R-22684 Qualified, Type RL Semi-Precision

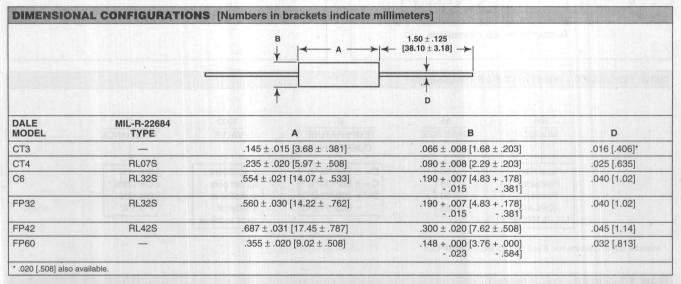




FEATURES

- All models except CT3 and FP60 (industrial) QPL to MIL-R-22684
- · Electroplated tin-lead solder finish leads
- RL07S, FP60, C6 and CT3 have blue epoxy insulation
- FP32 and FP42 have light blue ceramic cured paint insulation
- Semi-Precision resistors combine long-term stability with low inductance, low noise and low cost
- Ideal for preamplifiers, RF and IF circuits and other general purpose usage

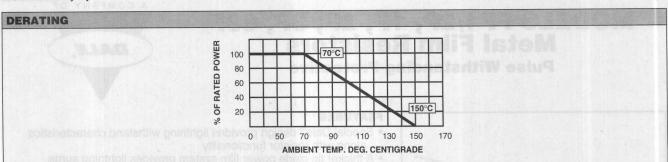
				WATTAG	E RATING	3	1 2 4	12.01	CONTROL TO MAKE		
		E	QUIV. MIL	ITARY		INDUSTI	RIAL	RESISTANCE	1- 1-11	TEMPERATURE	
DALE MODEL	IODEL TYPE	70°C	125°C	VOLTAGE RATING	70°C	125°C	VOLTAGE RATING	RANGE (Ohms)	STANDARD TOLERANCE	COEFFICIENT PPM/°C	
CT4	RL07S	1/4		250	1/2	1/8	300	10-1M	1, 2, 5%	100	
C6	RL32S	1		500		1/2	500	10-2M	1, 2, 5%	100	
СТЗ				- 10	1/4	1/8	200	1-499k	2, 5, 10%	100	
FP32	RL32S	1		500		_		10-1M	2, 5, 10%	100	
FP42*	RL42S*	2	wind —	500	314-11	-		10-1.5M	2, 5, 10%	150	
FP60	NO SERVICE	nod ac bon	65 JAJ	350	1/2	1/2	350	10-1M	1, 2, 5%	100	

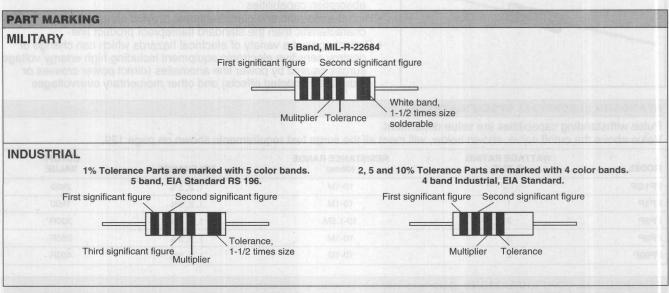


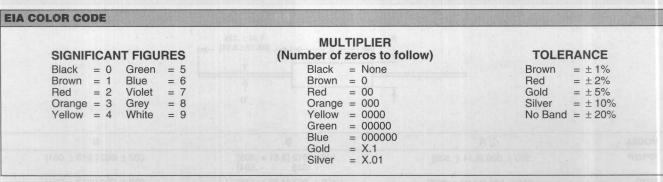
DALE MODEL	MIL-R-22684 TYPE	THERMAL SHOCK △R MAX. ± %	SHORT TIME OVERLOAD Δ R MAX. \pm %		MOISTURE RESISTANCE ΔR MAX. \pm %	$\begin{array}{c} \textbf{SHOCK} \\ \Delta \textbf{R MAX.} \pm \% \end{array}$	$\begin{array}{c} \text{VIBRATION} \\ \Delta \text{R MAX.} \pm \% \end{array}$	LOAD LIFE 1000 HOURS MIL RATING ΔR MAX. \pm %	TERMINAL STRENGTH ΔR MAX. \pm %	D. W. V. ∆R MAX. ± %	EFFECT SOLDER HEAT AR MAX. ± %
CT4	RL07S	0.25	0.25	0.25	0.5	0.1	0.1	0.5	0.1	0.1	0.1
C6	RL32S	0.25	0.25	0.25	0.5	0.1	0.1	2.0	0.1	0.1	0.1
СТЗ	_	0.25	0.50	0.25	0.5	0.1	0.1	1.0	0.2	0.1	0.1
FP32	RL32S	1.0	0.50	0.50	1.5	0.5	0.5	2.0	0.5	0.5	0.5
FP42	RL42S*	1.0	0.50	0.50	1.0	0.5	0.5	2.0	0.5	0.5	0.5
FP60		0.5	0.50	0.50	1.0	0.5	0.5	1.0	0.5	0.5	0.5

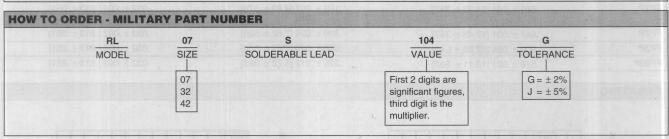
126

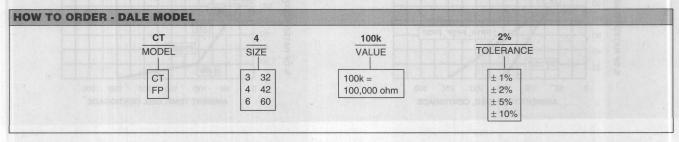
MODELS CT, C, FP











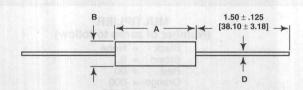
STANDARD ELECTRICAL SPECIFICATIONS

Pulse withstanding capabilities are value dependent.

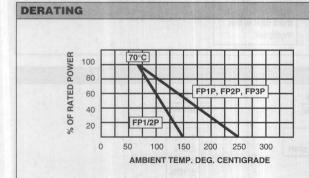
Value above the cutoff value, shown below, will meet all the surge test requirements shown on page 129.

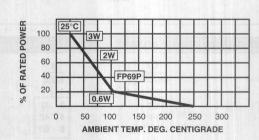
MODEL	WATTAGE RATING @ 70°C	RESISTANCE RANGE (Ohms)	TOLERANCE	CUTOFF
FP1/2P	1/2	10-1M	1, 2, 5%	2k00
FP1P	1	10-1M	1, 2, 5%	1k00
FP2P	2	10-1.5M	1, 2, 5%	300R
FP3P	3	10-1M	1, 2, 5%	250R
FP69P	2 1000 2	10-1M	1, 2, 5%	400R

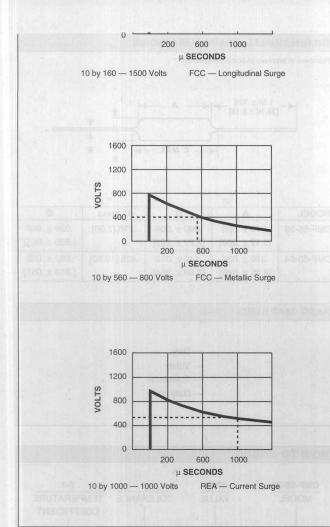
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

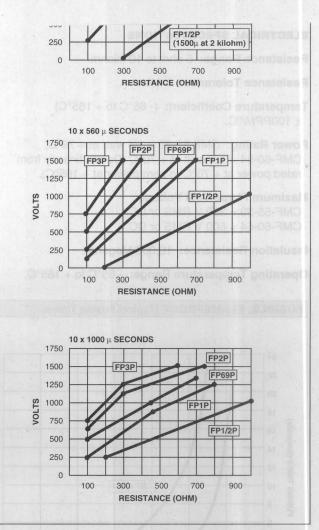


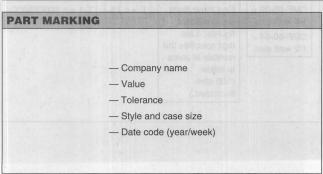
MODEL	Α	000000 = 3488 B	D
FP1/2P	.360 ± .020 [9.14 ± .508]	.138 + .012 [3.51 + .305] 023584]	$.032 \pm .002 [.813 \pm .051]$
FP1P	.560 ± .031 [14.22 ± .787]	.190 + .007 [4.83 + .178] 015381]	$.032 \pm .002$ [.813 $\pm .051$]
FP2P	.687 ± .031 [17.45 ± .787]	$.300 \pm .020 [7.62 \pm .508]$.032 ± .002 [.813 ± .051]
FP3P	.900 ± .055 [22.86 ± 1.40]	$.300 \pm .020 [7.62 \pm .508]$.032 ± .002 [.813 ± .051]
FP69P	.516 ± .021 [13.11 ± .533]	.225 ± .012 [5.72 ± .305]	.032 ± .002 [.813 ± .051]

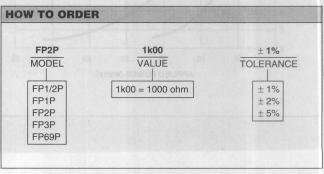








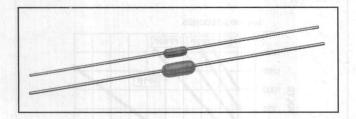




MODELS CMF-55-39 and CMF-60-64 Metal Film Resistors

Special Purpose, Fusible, Flameproof





ELECTRICAL SPECIFICATIONS

Resistance Range: 5 ohm to 10 kilohm.

Resistance Tolerance: ± 1%.

Temperature Coefficient: (- 65°C to + 165°C)

± 100PPM/°C.

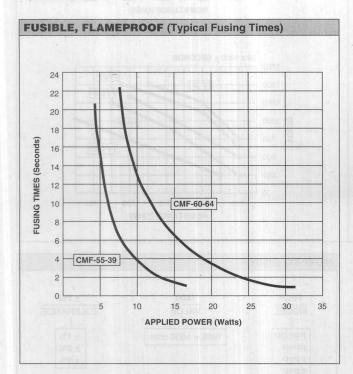
Power Rating: CMF-55-39 = 1/4 watt at + 70°C, CMF-60-64 = 1/2 watt at + 70°C (Derate linearly from rated power at + 70°C to zero power at + 165°C).

Maximum Flame Test Voltage:

CMF-55-39 = 350 V RMS or DC.CMF-60-64 = 500 V RMS or DC.

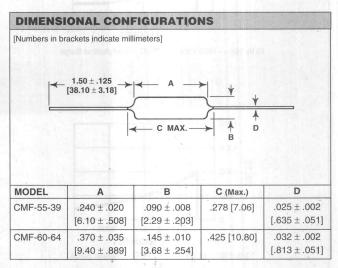
Insulation Resistance: 10,000 Megohm.

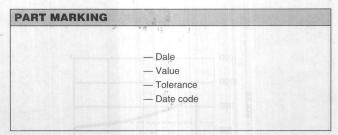
Operating Temperature Range: - 65°C to + 165°C.

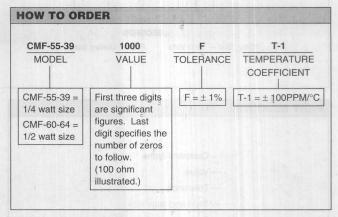


FEATURES

- Special filming and coating processes
- Fusible Circuit protection in case of other component failure
- Flameproof Meets EIA RS-325, will not flame when overloaded



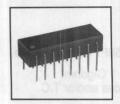




MODEL R-1C-16A Metal Film Resistor Networks

Discrete, Special Purpose, Dual-In-Line Molded, Schematic - Isolated





FEATURES

- 16 pin package
- Designed to combine precision metal film resistor performance with advantages of network packaging

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 604 kilohm.

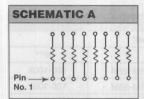
Resistance Tolerance: $\pm 0.1\%$, $\pm 0.25\%$, $\pm 0.5\%$, ± 1.0 , $\pm 2.0\%$.

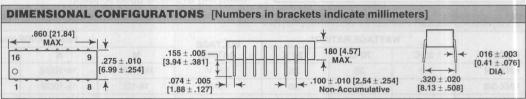
Resistance Temperature Coefficient: ± 10PPM/°C (B), ± 25PPM/°C (J),

± 50PPM/°C (H), ± 100PPM/°C (K).

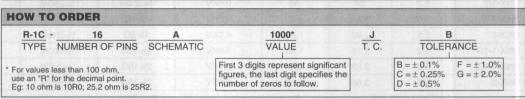
Resistor Power Rating: 0.2 watts at 70°C.

Package Power Rating: 1.6 watts at 70°C (derated to 0 at 125°C).





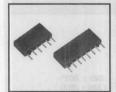
PART MARKING - Dale - Model - Value code - T.C. code - Tolerance code - Date code - Dot for pin one



MODELS R-4C and R-5C Metal Film Resistor Networks

Discrete, Special Purpose, Single-In-Line Molded, Schematics - Isolated or Pin One Common





FEATURES

- 6 or 8 pin package
- Designed to combine precision metal film resistor performance with advantages of network packaging

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 604 kilohm.

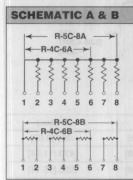
Resistance Tolerance: $\pm 0.1\%$, $\pm 0.25\%$, $\pm 0.5\%$, ± 1.0 .

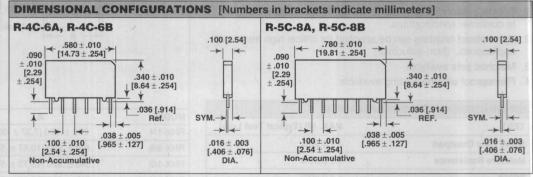
Resistance Temperature Coefficient: ± 10PPM/°C (B), ± 25PPM/°C (J),

± 50PPM/°C (H), ± 100PPM/°C (K).

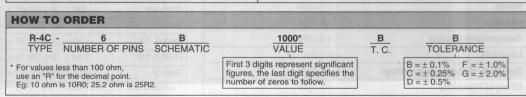
Resistor Power Rating: 0.1 to 0.2 watts at 70°C.

Package Power Rating: 1 watt at 70°C (derated to 0 at 125°C).





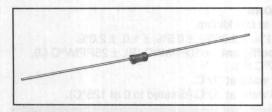
PART MARKING - Dale - Model - Value code - T.C. code - Tolerance code - Pin one indicator



MODEL RNX Metal Oxide Resistors

High Voltage, Special Purpose





FEATURES

- · For oil bath or open air operation
- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50PPM/°C available.
- Tolerance: ± 1% standard to 1 Gigohm. ± 5% above 1 Gigohm. ± 0.5% available in 50PPM/°C only. Special tolerances and/or T.C. matching available upon request.

STANDARD	ELECTRIC	AL SPECIF	ICATIONS		Local Section Co.					
	w	ATTAGE RAT	NG*	VOLTAGE RATING	RESISTANCE (Ohms)**					
MODEL	25°C	70°C	125°C		M	K	Н	N***		
RNX-1/4	.5	.36	.25	750 V	1k-100M	1k-100M	1M-22M	100-100k		
RNX-3/8	1.0	.72	.50	1.5KV	1k-1G	1k-100M	1M-50M	100-100k		
RNX-1/2	1.2	.86	.60	2.0KV	1k-2.0G	1k-250M	1M-100M	100-100k		
RNX-3/4	2.0	1.44	1.0	3.0KV	1k-3G	1k-500M	1M-100M	100-100k		
RNX-1	2.5	1.80	1.25	4.0KV	1k-5G	1k-500M	1M-100M	100-1M		
RNX-1-1/4	3.0	2.16	1.50	5.0KV	2k-10G	1k-500M		100-1M		
RNX-1-1/2	4.0	2.88	2.0	6.0KV	2k-10G	1k-500M	- 1.5	100-1M		
RNX-2	5.0	3.60	2.50	8.0KV	2k-10G	1k-500M	_ 1	100-1M		

^{*} Increase wattage by 25% for .032 [.813] diameter leads. ** For resistance values above and below those listed, contact factory. *** Non-inductive ± 200PPM/°C T.C. only. All resistance readings referenced at 100 VDC. Other voltages upon request.

ELECTRICAL SPECIFICATIONS

Dielectric Strength: 750 VDC all styles.

Insulation Resistance: 10,000 Megohm minimum.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test for all styles. **Solderability:** Continuous satisfactory coverage when

tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS

Element: High temperature fired cermet film.

Core: High purity 96% alumina.

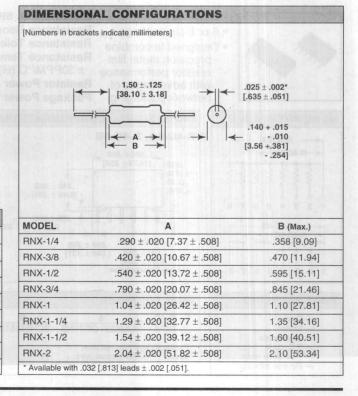
Coating: Flameproof silicone or flame-retardant epoxy.
Termination: Standard lead material is solder-coated copper. Solderable and weldable.

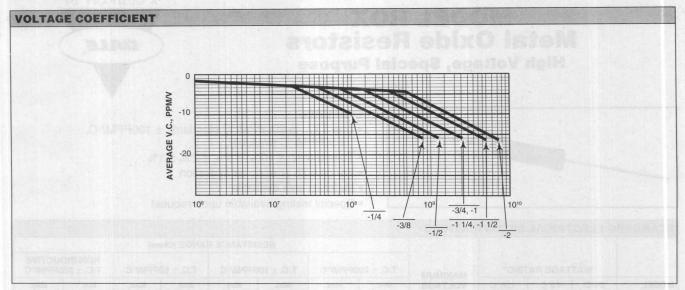
SPECIAL MODIFICATIONS

- Special preconditioning (power aging, temperature cycling, etc.) to customer specifications.
- Non-helixed resistors can be supplied for critical high frequency applications. (Non-inductive.)
- 3. Matched sets available.
- 4. Flameproof silicone coating available.

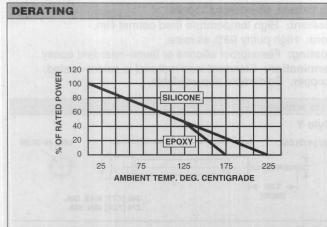
ENVIRONMENTAL PERFORI	MANCE
TEST	MAX. ∆R (Typical Test Lots)
Short Time Overload	< ± 0.20%
Moisture Resistance	< ± 0.50%
Shock	< ± 0.20%
Vibration	< ± 0.20%
Temperature Cycling	< ± 0.50%
Load Life	<±1.0%
Dielectric Withstanding Voltage	<±0.15%
Effect of Soldering	< ± 0.10%

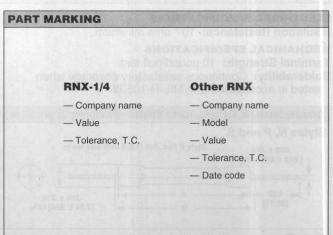
TEMPERA	TURE COEFFICIENT C	ODE
CODE	T.C.	RANGE
M	± 200PPM/°C	- 55°C to + 125°C
K	± 100PPM/°C	+ 25°C to + 125°C
Harry Mary B	± 50PPM/°C	+ 25°C to + 125°C

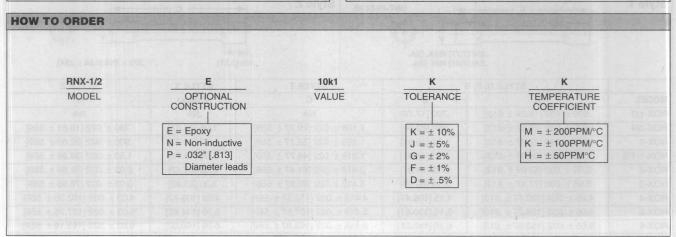




SISTANCE	VALUE CODE	5					
KII		ME		GIO		TEI	RA
10)3	10	O ⁶	10) ⁹	10	12
VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1k	1k0	1M	1M0	1KM	1G0	1MM	1T0
5.5k	5k5	5.5M	5M5	5.5KM	5G5	5.5MM	5T5
9.99k	9k99	9.99M	9M99	9.99KM	9G99	9.99MM	9T99



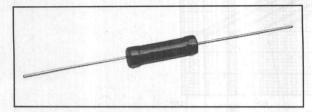




MODEL ROX Metal Oxide Resistors

High Voltage, Special Purpose





FEATURES

- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50PPM/°C available.
- Tolerances: ± 10%, ± 5%, ± 2%, ± 1%
- For oil bath or open air operation
- Matched sets available
- Special testing available upon request

					RESISTANCE RANGE (Ohms)									
	WATTAGE RATING*			MAXIMUM	T.C. ± 20	T.C. ± 200PPM/°C		T.C. ± 100PPM/°C		0PPM/°C	NON-INDUCTIV			
MODEL	25°C	70°C	125°C	VOLTAGE	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
ROX-1/2	2.0	1.4	1.0	2.0KV	1k	1G	1k	100M	1M	100M		-		
ROX-3/4	3.0	2.16	1.5	5.0KV	1k	4G	1k	500M	1M	100M	100	1M		
ROX-1	4.0	2.88	2.0	7.5KV	1k	5G	1k	500M	1M	100M	100	1M		
ROX-1-1/2	5.0	3.6	2.5	11.0KV	1.5k	7.5G	1.5k	500M	1M	100M	100	1M		
ROX-2	6.0	4.32	3.0	15.0KV	2k	10G	2k	1G	1M	500M	100	1M		
ROX-3	10.0	7.2	5.0	22.5KV	3k	15G	3k	1G	1M	500M	400	10M		
ROX-4	12.0	8.64	6.0	30.0KV	4k	20G	4k	1G	1M	500M	500	10M		
ROX-5	16.0	11.52	8.0	37.5KV	5k	25G	5k	1G	1M	500M	500	10M		
ROX-6	20.0	14.4	10.0	45.0KV	6k	30G	6k	1G	1M	500M	500	10M		

ELECTRICAL SPECIFICATIONS

Insulation Resistance: 1011 ohm minimum.

MECHANICAL SPECIFICATIONS

Terminal Strength: 10 pound pull test.

Solderability: Continuous satisfactory coverage when

tested in accordance with MIL-R-10509.

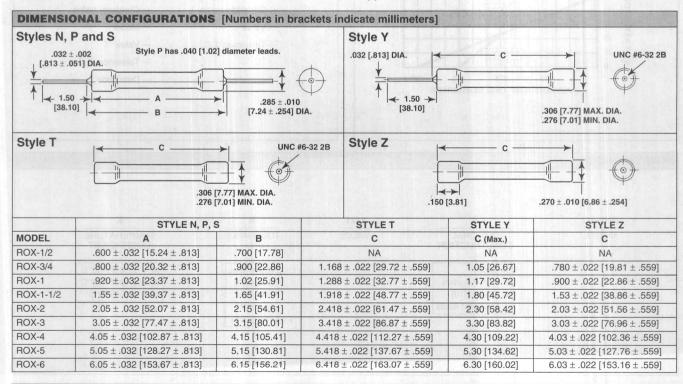
MATERIAL SPECIFICATIONS

Element: High temperature fired cermet film.

Core: High purity 96% alumina.

Coating: Flameproof silicone or flame-retardant epoxy. **Termination:** Standard lead material is solder-coated.

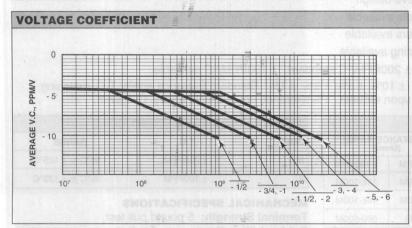
copper. Solderable and weldable.



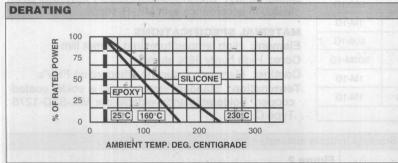
MODEL ROX

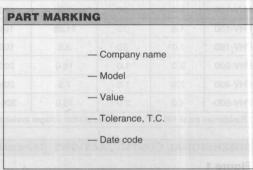
RESISTANCE VALUE CODES				4			
KIL		The second secon	M MEGA		A	TEF	RA
10	3	10	06	10	9	10	12
VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1k	1k0	1M	1M0	1KM	1G0	1MM	1T0
5.5k	5k5	5.5M	5M5	5.5KM	5G5	5.5MM	5T5
9.99k	9k99	9.99M	9M99	9.99KM	9G99	9.99MM	9T99

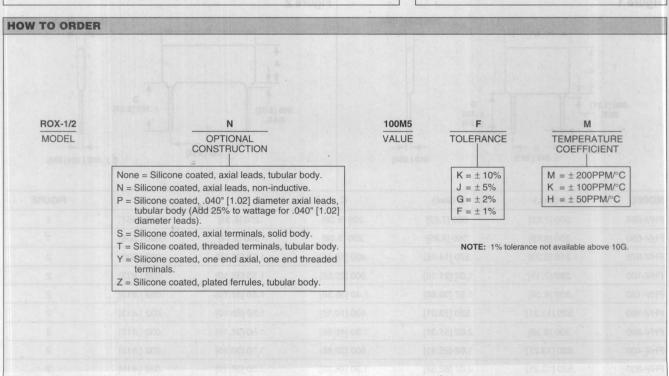
TEMPERATURE COEFFICIENT CODE			
CODE	TEMPERATURE COEFFICIENT	RANGE	
M	± 200PPM/°C	- 55°C to + 125°C	
К	± 100PPM/°C	+ 25°C to + 125°C	
HUTAI	± 50PPM/°C	+ 25°C to + 125°C	



ENVIRONMENTAL PERFORMANCE		
TEST 2	MAX. ∆R (Typical Test Lots)	
Short Time Overload	< ± 0.20%	
Moisture Resistance	< ± 0.50%	
Shock	< ± 0.20%	
Vibration	< ± 0.20%	
Temperature Cycling	< ± 0.50%	
Load Life	< ± 1.5%	
Dielectric Withstanding Voltage	< ± 0.15%	
Effect of Soldering	< ± 0.10%	



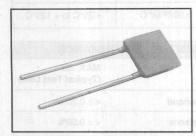




MODEL FHV Metal Oxide Resistors

High Voltage, Special Purpose





FEATURES

- Non-inductive design
- · Matched sets available
- Ratio dividers available
- · Special testing available
- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C available.
- Tolerance: ± 10%, ± 5%, ± 2%, ± 1%. Standard tolerance and/or T.C. matching available upon request. 1% tolerance not available above 1 Gigohm.

STANDA	WATTAGE RATING		MAXIMUM VOLTAGE	RESISTANCE RANGE*		
MODEL	70°C		± 200PPM	± 100PPM		
FHV-025	.25	.125	.75	10k-100M	10k-100M	
FHV-050	.50	.25	1.5	10k-500M	10k-100M	
FHV-075	.25	.125	3.75	100-1G	500-500M	
FHV-100	1.0	.50	7.5	100-2G	500-1G	
FHV-150	1.5	.75	11.25	10k-2G	1M-1G	
FHV-160	1.0	.50	3.5	100-2G	500-1G	
FHV-200	2.0	1.0	15.0	200-8G	500M-1G	
FHV-400	2.0	1.0	7.5	20k-2G	1M-1G	
FHV-500	4.0	2.0	15.0	30k-10G	1M-1G	

TEMPERA"	TURE COEFFICIEN	T CODE
CODE	T.C.	RANGE
М	± 200PPM	- 55°C to + 125°C
K	± 100PPM	- 55°C to + 125°C

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pound pull test.

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-10509.

MATERIAL SPECIFICATIONS

Element: High temperature fired cermet film.

Core: High purity 96% alumina.

Coating: Flameproof silicone standard on FHV's.

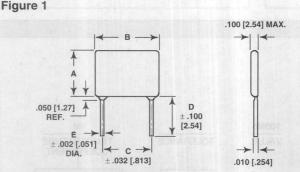
Termination: Standard lead material is solder coated copper. Solderable and weldable per MIL-STD-1276

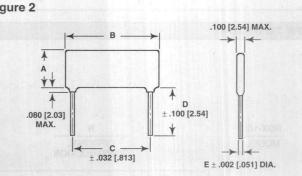
* Resistances are at 100 VDC. Resistances at other voltages available.

Type C.

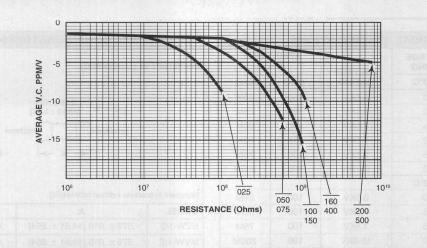
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

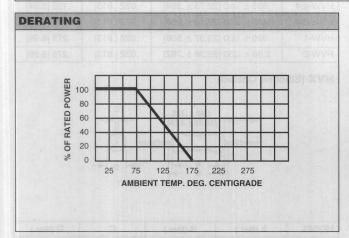
Figure 1 Figure 2

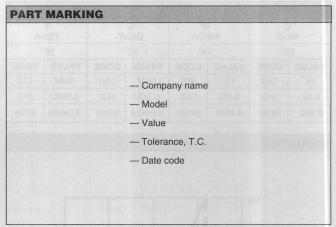


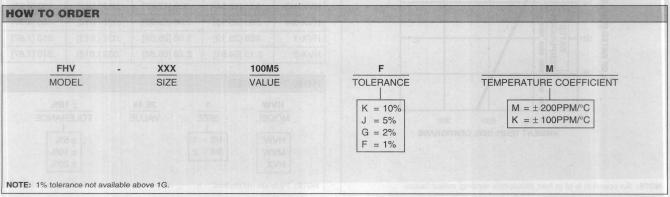


			E MAN THE STATE OF			
MODEL	A (Max.)	B (Max.)	C about lake	talemak [1 D t] *040 b	ataos ance Et a 9	FIGURE
FHV-025	.300 [7.62]	.300 [7.62]	.200 [5.08]	.250 [6.35]	.018 [.457]	1
FHV-050	.350 [8.89]	.350 [8.89]	.200 [5.08]	.360 [9.14]	.020 [.508]	1
FHV-075	.210 [5.33]	.570 [14.48]	.400 [10.16]	1.50 [38.10]	.025 [.635]	2
FHV-100	.280 [7.11]	1.07 [21.18]	.900 [22.86]	1.50 [38.10]	.032 [.813]	2
FHV-150	.330 [8.38]	1.57 [39.88]	1.40 [35.56]	1.50 [38.10]	.032 [.813]	2
FHV-160	.520 [13.21]	.520 [13.21]	.400 [10.16]	1.50 [38.10]	.032 [.813]	2
FHV-200	.330 [8.38]	2.02 [51.31]	1.90 [48.26]	1.50 [38.10]	.032 [.813]	2
FHV-400	.520 [13.21]	1.02 [25.91]	.900 [22.86]	1.50 [38.10]	.032 [.813]	2
FHV-500	.520 [13.21]	2.07 [52.58]	1.90 [48.26]	1.50 [38.10]	.032 [.813]	2





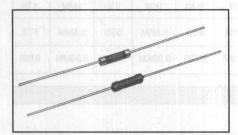




MODELS HVW, MVW, HVX Metal Alloy Resistors

High Voltage, Special Purpose





FEATURES

- HVW and MVW are uncoated. HVX is silicone coated.
- Semi-precision: ±5%, ±10%, ±20%. Closer tolerances available on HVX.
- Axial leads: HVW and HVX = Tinned copper. MVW = Copper clad steel.

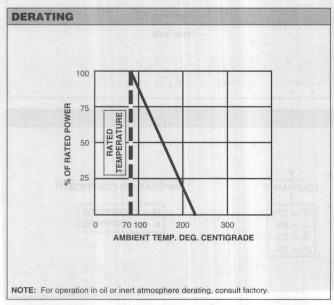
MATERIAL SPECIFICATIONS

Element: Metal alloy.

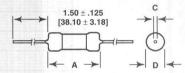
Core: Alkaline earth porcelain.

ST	ANDARD	ELECTRICAL	SPECIFICAT	IONS	
		WATTAGE RATING	VOLTAGE		TANCE ms)
	MODEL	@ 70°C	RATING	(Min.)	(Max.)
	HVW-1/2	1.0	3.5KV	100	25M
ED	MVW-1/2	1.0	3.5KV	100	25M
UNCOATED	HVW-3/4	1.5	7.5KV	100	50M
20	MVW-3/4	1.5	7.5KV	100	50M
5	HVW-1	2.5	7.5KV	100	75M
	HVW-2	5.0	15.0KV	100	200M
		@ 70°C	mes 7		
O	HVX-1/2	1.0	3.5KV	100	25M
COATED	HVX-3/4	1.5	7.5KV	100	50M
00	HVX-1	2.5	7.5KV	100	75M
	HVX-2	5.0	15.0KV	100	200M

RESIS'	TANCE	VALUE	CODE	S			
	K LO	M MEGA		G GIG	A	T TEF	RA
1	0 ³	1	06	10 ⁹	9	10	12
VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE
1k	1k0	1M	1M0	1KM	1G0	1MM	1T0
5.5k	5k5	5.5M	5M5	5.5KM	5G5	5.5MM	5T5
9.99k	9k99	9.99M	9M99	9.99KM	9G99	9.99MM	9T99



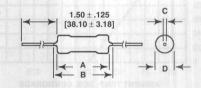
DIMENSIONAL CONFIGURATIONS HVW/MVW (Uncoated) C 1.50 ± .125 C (38.10 + 3.18)



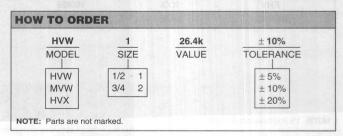
[Numbers in brackets indicate millimeters]

MODEL	Α	С	D (Max.)
HVW-1/2	.575 ± .010 [14.61 ± .254]	.032 [.813]	.155 [3.94]
MVW-1/2	.575 ± .010 [14.61 ± .254]	.032 [.813]	.155 [3.94]
HVW-3/4	.895 ± .010 [22.73 ± .254]	.032 [.813]	.155 [3.94]
MVW-3/4	.895 ± .010 [22.73 ± .254]	.032 [.813]	.155 [3.94]
HVW-1	.920 ± .020 [23.37 ± .508]	.032 [.813]	.275 [6.99]
HVW-2	2.08 ± .030 [52.38 ± .762]	.032 [.813]	.275 [6.99]

HVX (Silicone Coated)



MODEL	A (Max.)	B (Max.)	С	D (Max.)
HVX-1/2	.651 [16.54]	.680 [17.27]	.032 [.813]	.180 [4.57]
HVX-3/4	.988 [25.10]	1.06 [26.92]	.032 [.813]	.180 [4.57]
HVX-1	.988 [25.10]	1.06 [26.92]	.032 [.813]	.310 [7.87]
HVX-2	2.15 [54.61]	2.20 [55.88]	.032 [.813]	.310 [7.87]



MODEL SPW Carbon Film Resistors

Special Purpose, High Frequency Load (Tubes)



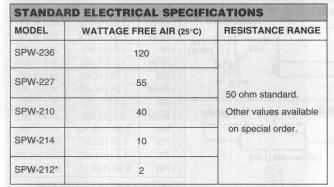


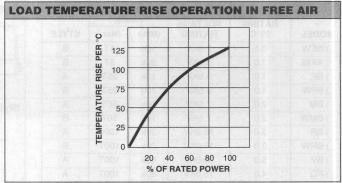
FEATURES

- High stability and excellent high frequency characteristics
- applications involving high power, high accuracy RF measurements
- Carbon film construction

APPLICATIONS

High frequency wattmeters for output measurement in Radio, TV and Radar Transmitters, dielectric · Particularly suited for high frequency heating and similar RF generating equipment. Ideal for use as non-reactive radio frequency terminations. Special high power designs with internal water cooling are available. Contact factory.





ELECTRICAL SPECIFICATIONS

Resistance Tolerance: \pm 5% and \pm 2% standard. Linearity tolerance ± 10%.

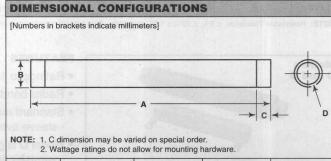
Cooling: Approximate increase in wattage when forced air cooling is employed is 3 times wattages shown and for liquid cooling (with heat exchanger) is 60 times wattages shown. The limiting factor insofar as the resistor is concerned is the film temperature. This should not exceed 200°C and for maximum stability should not exceed 150°C.

Temperature Coefficient: 200PPM/°C average. 250PPM/°C maximum.

MECHANICAL SPECIFICATIONS

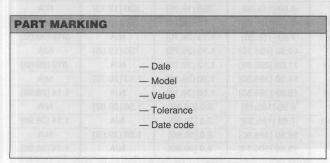
Identification: Type designation resistance value, tolerance and code date of manufacture are printed on each unit.

Terminations: All types electroplated copper except SPW-212. The SPW-212 has silver coated termination bands.



MODEL	Α	В	C (O.D.)	D (I.D.)
SPW-236	18.0 ± .062	1.75 ± .025	1.0 ± .063	1.25 ± .025
	[457.20 ± 1.57]	[44.45 ± .635]	[25.40 ± 1.60]	[31.75 ± .635]
SPW-227	12.0 ± .062	1.125 ± .025	.500 ± .032	.875 ± .020
	[304.80 ± 1.57]	[28.58 ± .635]	[12.70 ± .813]	[22.23 ± .508]
SPW-210	12.0 ± .062	.875 ± .010	.625 ± .032	.625 ± .020
	[304.80 ± 1.57]	[22.23 ± .254]	[15.88 ± .813]	[15.88 ± .508]
SPW-214	5.0 ± .032	.562 ± .006	.500 ± .032	.375 ± .013
	[127.0 ± .813]	[14.27 ± .813]	[12.70 ± .813]	[9.53 ± .330]
SPW-212*	2.0 ± .062 [50.80 ± 1.57]	.250 ± .006 [6.35 ± .152]	.250 ± .032 [6.35 ± .813]	Solid Rod

^{*} Representative types only. Consult factory for special requirements.

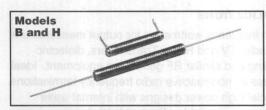


SPW -	210	50	5%
TYPE	SIZE	VALUE	TOLERANCE
	210 227	25 ohm - 600 ohm	2%
	212 236	available depending	5%
	214	on type. Please consult factory.	10%

MODELS B, H, D, G Carbon Film Resistors

High Voltage, Special Purpose





FEATURES

- \bullet Single units to 10 W, 40 KV, \pm 5% and matched pairs (BP) to 20 W, 80 KV, \pm 1%
- Radial lug or axial lead
- Supplied with Mylar® heat shrink protective sleeve .002" [.051] thick
- Model B is general purpose. Model H is high megohm, varnish coated.

STANDARD ELECTRICAL SPECIFICATIONS					
	WATTAGE	VOLTAGE	RESISTANCE (Ohms)		
MODEL	25°C	RATING	(Min.)	(Max.)	STYLE
() AEW	0.5	2.5KV	10k	201T	В
() AKW	1.0	5.0KV	20k	5T	В
()BF	1.0	3.5KV	10k	25T	Α
() BFW	1.0	3.5KV	10k	25T	В
() BM	2.0	7.5KV	10k	50T	Α
()BMW	2.0	7.5KV	10k	50T	В
()BR	3.0	15.0KV	20k	100T	Α
() BRW	3.0	15.0KV	20k	100T	В
()BV	5.0	30.0KV	40k	100T	Α
() FQ	4.0	15.0KV	20k	100T	Α
() FT	6.0	25.0KV	40k	100T	Α
() FW	10.0	40.0KV	70k	100T	Α

DIMENSIONAL CONFIGURAT	IONS		
Style A	MODEL	A	В
.093 [2.36] DIA.	() AEW	.750 [19.05]	.250 [6.35]
Screw (A .719	() AKW	1.50 [38.10]	.250 [6.35]
6-32 [18.26]	() BF	1.0 [25.40]	.313 [7.95]
(a) +	() BFW	1.0 [25.40]	.313 [7.95]
→ B	() BM	1.75 [44.45]	.313 [7.95]
No. of the second secon	() BMW	1.75 [44.45]	.313 [7.95]
Chule B	() BR	3.0 [76.20]	.313 [7.95]
Style B 2.0 [50.80]	() BRW	3.0 [76.20]	.313 [7.95]
* A -> ->	() BV	5.50 [139.70]	.313 [7.95]
	() FQ	2.50 [63.50]	.563 [14.30]
→ .040 [1.02]	() FT	4.0 [101.60]	.563 [14.30]
	() FW	6.50 [165.10]	.563 [14.30]
[Numbers in brackets indicate millimeters]	copper. Dir	ial leads are #20 AV mensional tolerance I%, whichever is gre	s are ± .016

NOTE: Resistance Tolerance: \pm 5%, \pm 10%, \pm 15% all models. First letter of nomenclature in charts variable depending on Model B or H, required.



FEATURES

- Ratings to 100 W, 125 KV, ± 5%
- · Radial bands or ferrule terminals
- Standard models varnish coated, vinyl protective sleeve available
- Model D is general purpose. Model G is non-inductive, varnish coated.

STAND	ARD ELECT	TRICAL SP	ECIFIC	ATION	S
75 ± .020	WATTAGE RATING VOLTA	VOLTAGE	RESISTANCE (Ohms)		TEM I
MODEL	25°C	RATING	(Min.)	(Max.)	STYLE
() JU	10	25KV	20	100G	С
() PW	20	35KV	20	100G	С
() PW-1	20	35KV	20	100G	D
()PX	30	65KV	30	100G	С
() PX-1	30	65KV	30	100G	D
() VY	60	90KV	35	100G	С
() VY-1	60	90KV	35	100G	D
() ZW	35	40KV	20	100G	С
() ZW-1	35	40KV	20	100G	D
() ZZ	100	125KV	30	100G	С
() ZZ-1	100	125KV	30	100G	D

PA	ART MARKING
	B, H, D, G
	- Company name
-	- Model
-	- Value
_	- Tolerance
	- Date code

HOW TO	ORDER	- B, H, D, G
() AEW	2M50	± 15%
MODEL	VALUE	TOLERANCE
		± 15%
		± 15% ± 10% ± 5%
		± 5%

Style C .172 [4.37]	DIA313 [7.95] .7.	Styl	.516 [13.11]	→ B ←
MODEL	Α	B*	С	D
() JU	4.50 [114.30]	.750 [19.05]	.500 [12.70]	N/A
()PW	6.50 [165.10]	1.13 [28.70]	.750 [19.05]	N/A
() PW-1	7.69 [195.33]	1.13 [28.70]	N/A	.812 [20.62]
()PX	10.50 [266.70]	1.13 [28.70]	.750 [19.05]	N/A
() PX-1	11.69 [296.93]	1.13 [28.70]	N/A	.812 [20.62]
() VY	14.50 [368.30]	1.50 [38.10]	1.13 [28.70]	N/A
() VY-1	15.69 [398.53]	1.50 [38.10]	N/A	1.14 [28.96]
() ZW	6.50 [165.10]	2.0 [50.80]	1.56 [39.62]	N/A
/ \ ==== /	7.69 [195.33]	2.0 [50.80]	N/A	1.14 [28.96]
() ∠VV-1		Commence of the Commence of th		
() ZW-1 () ZZ	18.50 [469.90]	2.0 [50.80]	1.56 [39.62]	N/A

STANDARD ELECTRICAL SPECIFICATIONS					
MODEL	WATTAGE RATING 40°C	MAXIMUM VOLTS	RESISTANCE RANGE (Ohms)		
HACW-2	.25	1500	10G-1T		
HADW-2	.50	5KV	10G-1T		
M-51	.50	500V	100M-10T		

ELECTRICAL SPECIFICATIONS

Tolerance:

M-51 = 1%, 2%, 5%, 10%. HACW-2 and HADW-2 = 5%, 10%, 20%.

Temperature Coefficient:

 $10^7 - 10^9 = 1500 PPM/^{\circ}C.$

Over 10^9 - $10^{11} = 2000$ PPM/°C. Over 10^{11} - $10^{12} = 2800$ PPM/°C.

(T.C.'s are typical only and are ALWAYS NEGATIVE.)

Noise: Not normally measurable.

Shelf life: < 0.5% per year.

Load Life at 85°C: Under DC cyclic load average $\Delta R < 1\%$.

Maximum 2%.

Maximum Temperature: 125°C.

Temperature Cycling: < 0.5% per MIL-R-14293.

Moisture Cycle: M-51 hermetically sealed;

effects of moisture nil.

MECHANICAL SPECIFICATIONS

Identification: Type designation, resistance value and

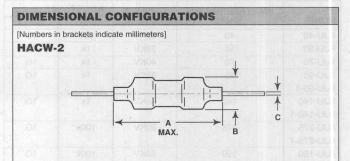
tolerance are stamped on each unit.

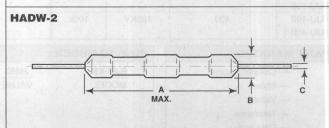
Insulation:

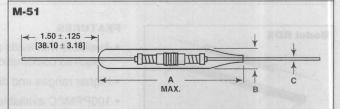
HACW-2 and HADW-2 = heat shrunk polyolefin.

M-51 = glass sealed.

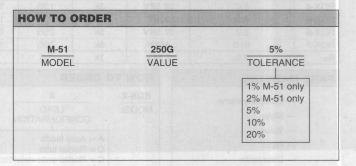
PART MARKING — Company name — Model — Value — Tolerance — Date Code







MODEL	A (Max.)	В	C
HACW-2	.600 [15.24]	.140 ± .010 [3.56 ± .254]	.025 [.635]
HADW-2	1.07 [27.18]	.140 ± .010 [3.56 ± .254]	.025 [.635]
M-51	1.88 [47.75]	.220 ± .010 [5.59 ± .254]	.020 [.635]



MODELS RJU and RDX Metal Oxide Resistors

Special Purpose, High Power, Ultra High Value - RJU Special Purpose, High Voltage, Ratio Divider - RDX





FEATURES

- Wattages to 400 watt at 25°C
- Derated to 0 at 230°C
- Voltages to 125KV
- Tolerances: ± 1%, ± 2%, ± 5%, ± 10%
- Two terminal styles, Style C Tab Terminal and Style D Ferrule Terminal

STANDARD ELECTRICAL SPECIFICATIONS					
	WATTAGE RATING	VOLTAGE	RESISTAN	NCE (Ohms)	
MODEL	125°C	RATING	(Min.)	(Max.)	
RJU-40	40	25KV	500	1G	
RJU-50	50	33KV	1k	1G	
RJU-70	70	40KV	1k	1G	
RJU-95	95	35KV	1k	1G	
RJU-95-1					
RJU-140	140	65KV	1k	1G	
RJU-140-1					
RJU-275	275	90KV	100k	1G	
RJU-275-1					
RJU-150	150	40KV	100k	1G	
RJU-150-1					
RJU-400	400	125KV	100k	1G	
RJU-400-1		Per Control			

DIMENSIO	DIMENSIONAL CONFIGURATIONS					
MODEL	LENGTH	DIAMETER	STYLE			
RJU-40	4.50,[114.30]	.750 [19.05]	С			
RJU-50	6.0 [152.40]	.750 [19.05]	С			
RJU-70	8.0 [203.20]	.750 [19.05]	С			
RJU-95	6.50 [165.10]	1.13 [28.70]	С			
RJU-95-1	7.69 [195.33]	1.13 [28.70]	D			
RJU-140	10.50 [266.70]	1.13 [28.70]	С			
RJU-140-1	11.69 [296.93]	1.13 [28.70]	D			
RJU-275	14.50 [368.30]	1.50 [38.10]	С			
RJU-275-1	15.69 [398.53]	1.50 [38.10]	D			
RJU-150	6.50 [165.10]	2.0 [50.80]	С			
RJU-150-1	7.69 [195.33]	2.0 [50.80]	D			
RJU-400	18.50 [469.90]	2.0 [50.80]	С			
RJU-400-1	19.69 [500.13]	2.0 [50.80]	D			

Company nameStyleValue

— Tolerance

PART MARKING

Date code

RJU-XX	2M50	K	Macanage & K Man
MODEL	VALUE	TOLERANCE	TEMPERATURE COEFFICIENT
		K = ± 10% G = ± 2%	$M = \pm 200PPM/^{\circ}C$
		$J = \pm 5\%$ $F = \pm 1\%$	$K = \pm 100PPM/^{\circ}C$



FEATURES

- Available with leads and/or mounting lugs in any required combination
- Higher ranges and different sizes available on request
- 100PPM/°C available
- T.C. matching

STANDARD ELECTRICAL SPECIFICATIONS						
[888.]	WATTAGE RATING	VOLTAGE	RESISTANCE (Ohms)		MAXIMUM	
MODEL	125°C	Ri	(Min. R ₁)	(Max. R ₂)	RATIO	
R ₁						
RDX-2	2.0	7.5KV	1k	1G	5000:1	
RDX-3	3.0	15KV	2k	10G	10000:1	
RDX-4	5.0	22.5KV	3k	15G	10000:1	
RDX-5	6.0	30KV	4k	20G	10000:1	
RDX-6	8.0	37.5KV	5k	25G	10000:1	
RDX-7	10.0	45KV	6k	30G	10000:1	
R ₂	2.0	7.5KV	1k	1G		

DIMENSIONAL CONFIGURATIONS					
MODEL	LENGTH MAXIMUM	DIAMETER MAXIMUM			
Rı					
RDX-2 1.29 [32.77]		.325 [8.26]			
RDX-3	2.42 [61.47]	.325 [8.26]			
RDX-4	3.42 [86.87]	.325 [8.26]			
RDX-5	4.42[112.27]	.325 [8.26]			
RDX-6	5.42 [137.67]	.325 [8.26]			
RDX-7	6.42 [163.07]	.325 [8.26]			
R ₂	1.29 [32.77]	.325 [8.26]			

[Numbers in brackets indicate millimeters]

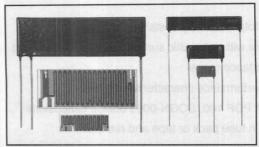
PART MARKING				
	Company name Style Value Ratio			
	RatioDate code			

HOW TO ORDER								
RDX-X	Α	2M50	1000:1	F	K			
MODEL	LEAD CONFIGURATION	VALUE	RESISTANCE RATIO	TOLERANCE	TEMPERATURE COEFFICIENT			
	A = Axial leads D = Radial tabs C = Radial ends axial tap		R ₁ : R ₂	$K = \pm 10\%$ $G = \pm 2\%$ $J = \pm 5\%$ $F = \pm 1\%$	M = ± 200PPM/°C			

MODELS TR and TD Thick Film Resistors and Dividers

Special Purpose, High Voltage





FEATURES

- 0.25 watt to 3.0 watt at 25°C
- Outstanding stability under adverse conditions
- Stable cermet resistive element bonded to a high-purity alumina substrate
- Tough epoxy-based coating and high voltage stability
- Designs built from customer supplied schematics
- · Dividers available leaded or non-leaded
- Typical resistance ratios of 1000:1, 2000:1, etc.
- TCR tracking to 10PPM/°C depending on values
- Typical thickness of .055" [1.40] for space preservation

APPLICATIONS

Applications include power supplies, transformers and any application requiring operation within an environment where high voltages are used.

ELECTRICAL SPECIFICATIONS

Resistance Range: 500 ohm to 1000 Megohm. Resistance Tolerance: \pm 1% to \pm 20% standard.

Ratio Tolerance: 0.25% to 5% standard.

Temperature Coefficient: < 200PPM/°C; Ratio TC to 5PPM/°C.

Maximum Voltage: 25,000 volts.

Insulation Resistance: 10,000 Megohm minimum.

Voltage Coefficient: 2PPM/°C per volt standard, tighter available.

Dielectric Strength: 5,000 volts, $\Delta \le \pm 1\%$. **Moisture Resistance:** 0.5%, 240 hour test. **Load Life:** 0.5%, 1000 hours at rated power.

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film. Substrate: 96% pure alumina.

Encapsulation: Epoxy base, conformal coating.

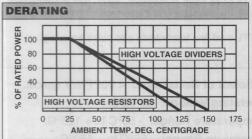
Terminals: 60/40 solder coated copper.

Terminal Strength: 4.5 pounds for 30 seconds. **Power:** Derated from ambient temperature 25°C.

ENVIRONMENTAL SPECIFICATIONS

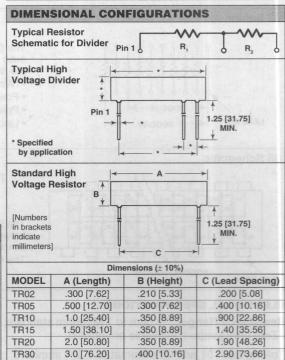
Temp. Range: - 55°C to + 125°C for resistors, to + 150°C for dividers.

Thermal Shock: .25% (5 cycles, - 55°C to + 125°C).



PART MARKING - Part number - Date code - Resistance value - Power rating - Tolerance value

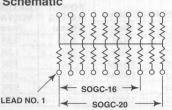
STANDARD ELECTRICAL SPECIFICATIONS								
MODEL	RESISTAL	NCE (Ohms)	POWER	MAXIMUM VOLTAGE				
	(Min.)	(Max.)	(Watts)	(Volts)				
TR03	300	40M	0.25	0.8K				
TR05	500	75M	0.5	1.5K				
TR10	1000	1000M	1.0	10K				
TR15	1500	1000M	1.5	15K				
TR20	2000	1000M	2.0	20K				
TR30	3000	1500M	3.0	30K				



						_				
MODE	20 LENGTH (± 10%)	POWER RATING	VALUE	TOLERANCE	MODEL	20 LENGTH (± 10%)	RATIO TCR (PPM)	VALUE/RATIO	RATIO TOLERANCE	STYLE
Shinm	First digit is number of inches, next digit is tenths of an inch.	C = 0.25 D = 0.5 F = 1.0 G = 1.5 H = 2.0 J = 3.0	First three digits are significant. The last digit specifies the number of zeros.	$F = \pm 1\%$ $G = \pm 2\%$ $H = \pm 3\%$ $J = \pm 5\%$ $K = \pm 10\%$ $M = \pm 20\%$	ind each indicate indicate indicate indicate	First digit is number of inches, next digit is tenths of an inch.	S = 10 R = 25 H = 50 K = 100 L = 200 M = 300	Resistance Value of R1: First three digits are significant. The last digit specifies the number of zeros. Ratio: R1/R2.	C = 0.25% D = 0.50% F = 1.0% G = 2.0% H = 3.0% J = 5.0%	L = Leaded N = Non- leaded

CIRCUIT APPLICATIONS

01 Schematic



15 or 19 resistors with one pin common

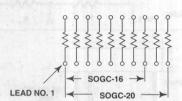
The SOGC-XX01 circuit provides a choice of 15 or 19 nominally equal resistors, each connected between a common lead (16 or 20) and a discrete P.C. board pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up

- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
- · High Speed Parallels Pull-up

paon or tape and teet pack

03 Schematic



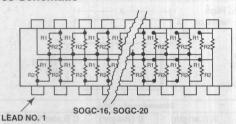
8 or 10 isolated resistors

The SOGC-XX03 circuit provides a choice of 8 or 10 nominally equal resistors with each resistor isolated from all others and wired directly across. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Powergate Pull-up
- Line Termination

- · Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



TTL dual-line terminator; pulse squaring, 14 or 18 pairs of resistors

(R, Resistors are common to leads 16 or 20)

(R_a Resistors are common to leads 8 or 10)

The SOGC-XX05 circuit contains 14 or 18 pairs of resistors. Each pair is connected between ground and a common line. The junctions of these resistor pairs are connected to the input leads.

The 05 circuits are designed for TTL dual-line termination and pulse squaring.

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm standard. Zero ohm jumpers available on request.

Tolerance: 01 and 03 schematic: \pm 2% standard. \pm 1%, \pm 5%, \pm 10% and \pm 20% available. 05 schematic: \pm 2% standard. \pm 5% available. 100 milliohm maximum on zero ohm jumper.

Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.

Resistor Power Rating: (Maximum at 70°C) 01, 05 schematic = .10 watt. 03 schematic = .19 watt.

Package Power Rating: (Maximum at 70°C) SOGC-16 = 1.6 watts. SOGC-20 = 2.0 watts.

T.C. Tracking: $(-55^{\circ}\text{C to} + 125^{\circ}\text{C}) 50\text{PPM/}^{\circ}\text{C}$.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 50 VDC.

Operating Temperature Range: - 55°C to + 125°C.

Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

Marking: Model number, schematic number, value code, tolerance code.

Marking Resistance to Solvents: Permanency testing

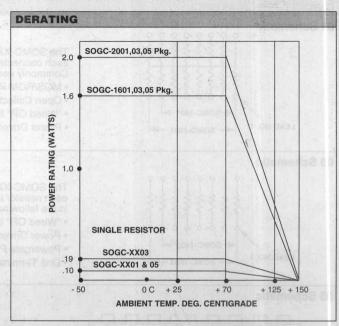
per MIL-STD-202, Method 215.

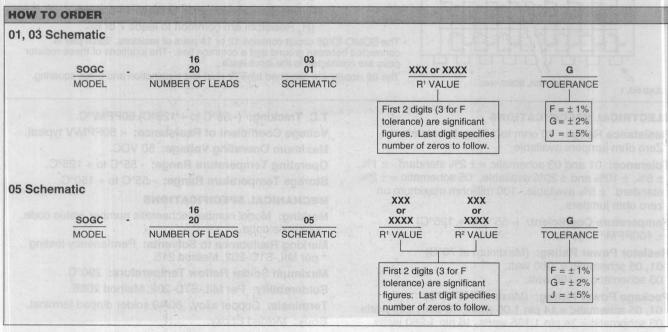
Maximum Solder Reflow Temperature: 290°C. Solderability: Per MIL-STD-202, Method 208E.

Terminals: Copper alloy. 60/40 solder dipped terminal.

Body: Molded epoxy.

ENVIRONMENTAL PERFORMANCE *						
TEST	MAX. ∆R (Typical Test Lots)					
Power Conditioning	± 0.50% ΔR					
Thermal Shock	± 0.50% ΔR					
Short Time Overload	± 0.25% ΔR					
Low Temperature Operation	± 0.25% ΔR					
Moisture Resistance	± 0.50% ΔR					
Resistance to Soldering Heat	± 0.25% ΔR					
Shock	± 0.25% ΔR					
Vibration	± 0.25% ΔŘ					
Load Life	± 0.50% ΔR					
Terminal Strength	± 0.25% ΔR					
Insulation Resistance	10,000 Megohm (minimum)					
Dielectric Withstanding Voltage	No evidence of arcing or damag (200 V RMS for 1 minute)					
* Test methods per MIL-R-202.	mmer anicheke star					





MODEL SOMC Thick Film Resistor Networks

Dual-in-Line, Small Outline Molded Dip 01, 03, 05 Schematics - 14 or 16 Pins

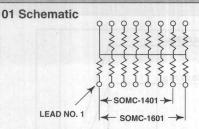




FEATURES

- .090" [2.29] maximum seated height
- · Rugged, molded case construction
- · Highly stable thick film
- .050" [1.27] lead spacing
- Low temperature coefficient, (-55°C to + 125°C) ± 100PPM/°C
- · Reduces total assembly costs
- Compatible with automatic surface mounting equipment
- Wide resistance range
- Uniform performance characteristics
- Meets EIA PDP100, SOGN-0002 outline dimensions
- Available in tube pack or tape and reel pack

CIRCUIT APPLICATIONS

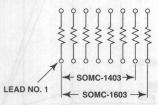


15 or 19 resistors with one pin common

The SOMC-XX01 circuit provides a choice of 13 or 15 nominally equal resistors, each connected between a common pin (14 or 16) and a discrete P.C. board pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up
- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
- · High Speed Parallels Pull-up

03 Schematic

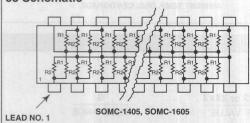


7 or 8 isolated resistors

The SOMC-XX03 circuit provides a choice of 7 or 8 nominally equal resistors with each resistor isolated from all others and wired directly across. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Powergate Pull-up
- Line Termination
- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



TTL dual-line terminator; pulse squaring, 12 or 14 pairs of resistors

(R, Resistors are common to leads 14 or 16)

(R_o Resistors are common to leads 7 or 8)

The SOMC-XX05 circuit contains 12 or 14 pairs of resistors. Each pair is connected between ground and a common line. The junctions of these resistor pairs are connected to the input leads.

The 05 circuits are designed for TTL dual-line termination and pulse squaring.

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm standard. Zero ohm jumpers available.

Tolerance: 01 and 03 schematic = \pm 2% standard. \pm 1%, \pm 5%, \pm 10% and \pm 20% available. 05 schematic = \pm 2% standard. \pm 5% available. 100 milliohm maximum on zero ohm jumpers.

Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.

Resistor Power Rating: (Maximum at 70°C)

01, 05 schematic = .080 watt. 03 schematic = .160 watt.

Package Power Rating: (Maximum at 70°C)

01, 05 schematic = 14 pin 1.05 watts, 16 pin 1.200 watts. 03 schematic = 14 pin 1.125 watts, 16 pin 1.280 watts. T.C. Tracking: (-55°C to + 125°C) 50PPM/°C.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 50 VDC.

Operating Temperature Range: - 55°C to + 125°C.

Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

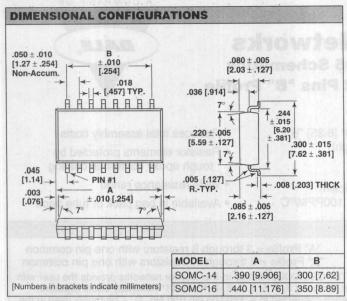
Marking: Model number, schematic number, value code, tolerance code.

Marking Resistance to Solvents: Permanency testing per MIL-STD-202, Method 215.

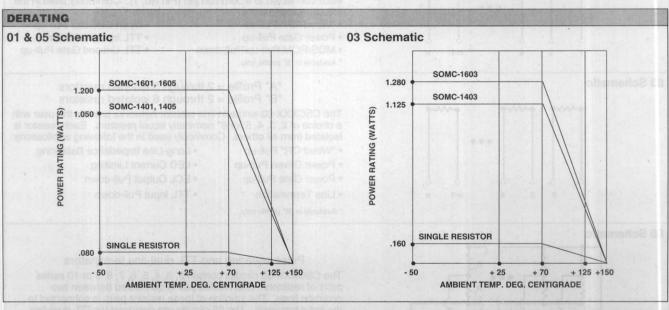
Maximum Solder Reflow Temperature: 290°C. Solderability: Per MIL-STD-202, Method 208E.

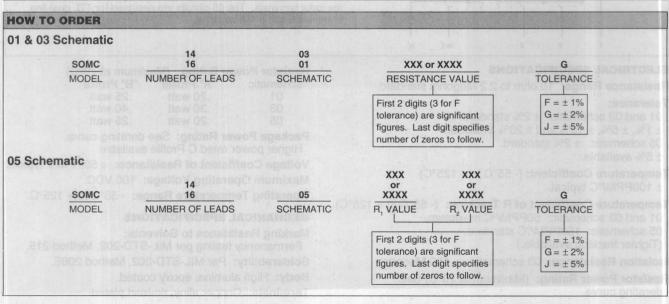
Terminals: Copper alloy. 60/40 solder dipped terminal.

Body: Molded Epoxy.



ENVIRONMENTAL PERFORMANCE *							
TEST	MAX. ∆R (Typical Test Lots)						
Power Conditioning	± 0.50% ΔR						
Thermal Shock	± 0.50% ΔR						
Short Time Overload	± 0.25% ΔR						
Low Temperature Operation	± 0.25% ΔR						
Moisture Resistance	± 0.50% ΔR						
Resistance to Soldering Heat	± 0.25% ΔR						
Shock Shock	± 0.25% ΔR						
Vibration	± 0.25% ΔR						
Load Life	± 0.50% ΔR						
Terminal Strength	± 0.25% ΔR						
Insulation Resistance	10,000 Megohm (minimum)						
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)						
* Test methods per MIL-STD-202.							

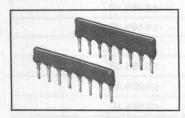




MODEL CSC Thick Film Resistor Networks

Single-In-Line, Coated - 01, 03, 05 Schematics 4 thru 10 Pins "A" Profile, 4 thru 12 Pins "B" Profile



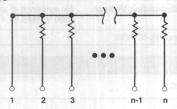


FEATURES

- .195" [4.95] "A" or .250" [6.35] "B" maximum seated height
- Highly stable thick film
- Low temperature coefficient
 (- 55°C to + 125°C) ± 100PPM/°C
- · Reduces total assembly costs
- Resistor elements protected by tough epoxy conformal coating
- · Wide resistance range
- Available in bag pack or tube pack

CIRCUIT APPLICATIONS

01 Schematic

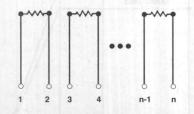


"A" Profile = 3 through 9 resistors with one pin common "B" Profile = 3 through 11 resistors with one pin common

The CSCXXX-01 single-in-line resistor networks provide the user with a choice of 3, 4, 5, 6, 7, 8, 9, 10* or 11* nominally equal resistors, each connected to a common pin (Pin No. 1). Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Gate Pull-up
- MOS/ROM Pull-up/Pull-down
- * Available in "B" profile only.
- Open Collector Pull-up
- TTL Input Pull-down
- TTL Unused Gate Pull-up

03 Schematic

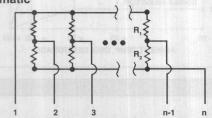


"A" Profile = 2 through 5 isolated resistors
"B" Profile = 2 through 6 isolated resistors

The CSCXXX-03 single-in-line resistor networks provide the user with a choice of 2, 3, 4, 5, or 6* nominally equal resistors. Each resistor is isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination
- * Available in "B" profile only
- Long-Line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



Pulse squaring and TTL dual-line terminators

The CSCXXX-05 circuits contain 2, 3, 4, 5, 6, 7, 8, 9 or 10 series pairs of resistors. Each series pair is connected between two common lines. The junction of these resistor pairs is connected to the input terminals. The 05 circuits are designed for TTL dual-line termination and pulse squaring.

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 2.2 Megohm standard.

Tolerance:

01 and 03 schematic: \pm 2% standard. \pm 1%, \pm 5%, \pm 10% and \pm 20% available.

05 schematic: ± 2% standard.

±5% available.

Temperature Coefficient: (- 55°C to + 125°C)

± 100PPM/°C typical.

Temperature Coefficient of R Tracking: (- 55°C to + 125°C)

01 and 03 schematic: 50PPM/°C maximum.

05 schematic: 150PPM/°C standard.

(Tighter tracking available.)

Isolation Resistance: 03 schematic: > 100 Megohm.

Resistor Power Rating: (Maximum at 25°C) See

derating curve.

Resistor Power Rating: (Maximum at 70°C)
Schematic "A" Profile "B" Profile
01 .20 watt .25 watt
03 .30 watt .40 watt
05 .20 watt .25 watt

Package Power Rating: See derating curve. Higher power rated C Profile available.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 100 VDC.

Operating Temperature Range: - 55°C to + 125°C.

MECHANICAL SPECIFICATIONS

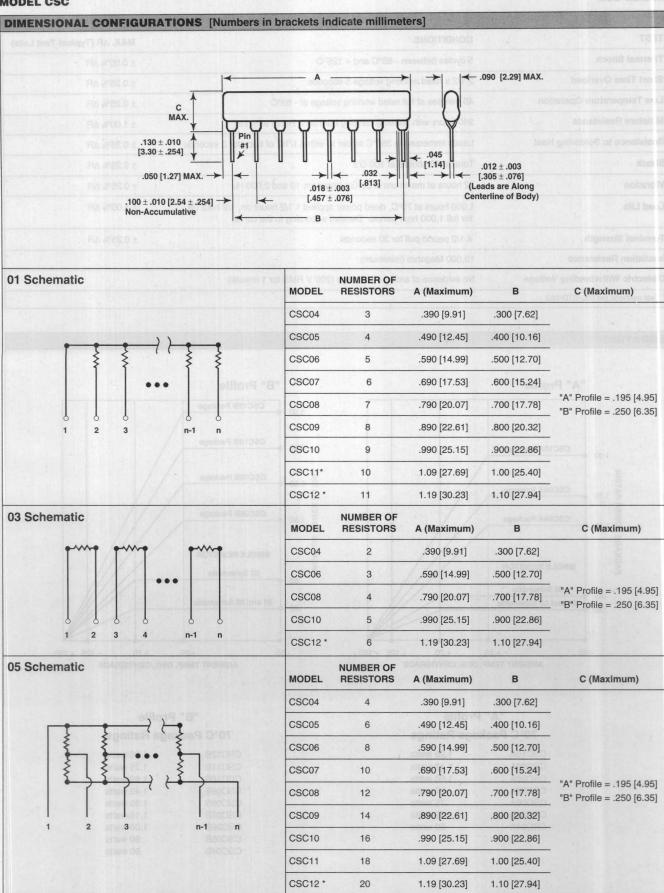
Marking Resistance to Solvents:

Permanency testing per MIL-STD-202, Method 215.

Solderability: Per MIL-STD-202, Method 208E.

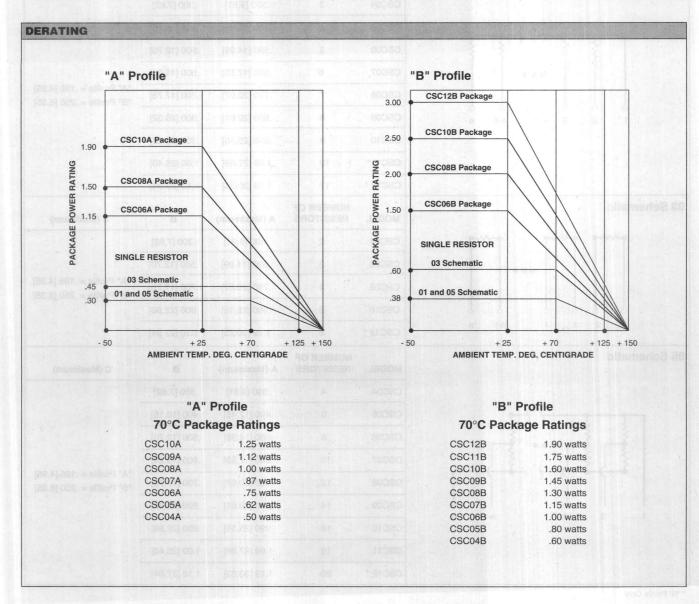
Body: High alumina, epoxy coated. **Terminals:** Copper alloy, tin-lead plated.

* "B" Profile Only



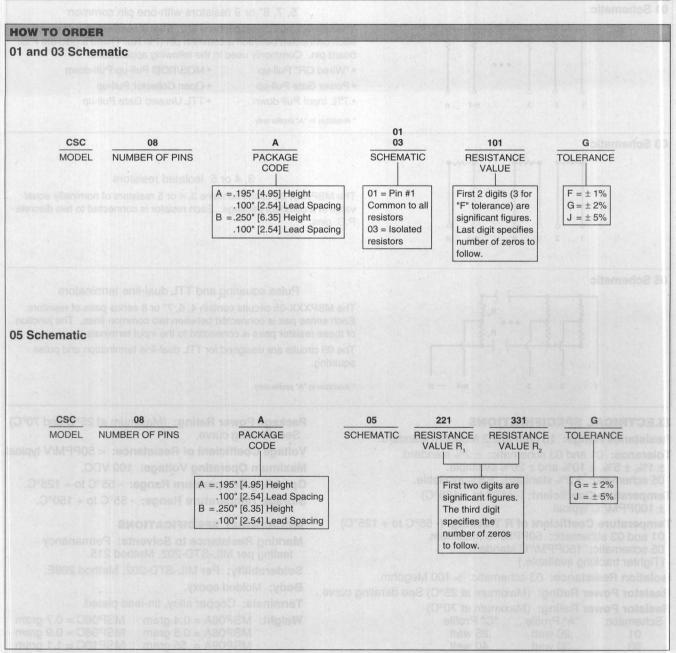
MODEL CSC

ENVIRONMENTAL PERFORMANCE *						
TEST	CONDITIONS	MAX. ∆R (Typical Test Lots)				
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR				
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR				
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR				
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 1.00% ΔR				
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR				
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR				
Vibration	12 hours at maximum of 20 G's betweem 10 and 2,000 Hz	± 0.25% ΔR				
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve.	± 1.00% ΔR				
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR				
Insulation Resistance	10,000 Megohm (minimum)					
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)	If Schematic				
* Test methods per MIL-STD-202.	(REDUCED) A SERVICESTA ESECTA					



MODEL CSC

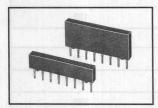
STOCK	ED RE	SISTAN	ICE VA	LUES IN	OHMS ("G" 1	F oleran	ce)			
01 Sche	ematic		03 Schematic					05 Schematic			
22	220	1.0k	5.6k	33k		56	470	2.7k	18k	R ₁ /R ₂	Zo
33	270	1.2k	6.8k	47k		100	510	3.3k	22k	220/270	121
56	330	1.5k	10k	68k		120	560	4.7k	27k	180/390	123
68	390	2.0k	12k	100k	02	150	1.0k	6.8k	47k	220/330	132
100	470	2.2k	15k	220k		180	1.5k	10k	100k	330/390	179
120	510	2.7k	18k	1 Meg	DIV 4	220	2.0k	12k	220k	330/470	194
150	560	3.3k	22k		nA + 1	330	2.2k	15k	1 Meg	330/680	222
180	680	4.7k	27k							1.5k/3.3k	1031



MODEL MSP Thick Film Resistor Networks

Single-In-Line, Molded - 01, 03, 05 Schematics 6, 8, 9 & 10 Pin "A" Profile - 6, 8 & 10 Pin "C" Profile



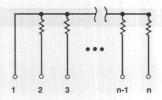


FEATURES

- .195" [4.95] "A" or .350" [8.89] "C" maximum seated height
- · Highly stable thick film
- Low temperature coefficient (- 55°C to + 125°C) ± 100PPM/°C
- Rugged, molded case construction
- · Reduces total assembly costs
- Compatible with automatic insertion equipment
- Reduces P.C. board space
- Wide resistance range
- Available in tube pack or side-by-side pack

CIRCUIT APPLICATIONS

01 Schematic

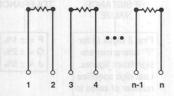


5, 7, 8* or 9 resistors with one pin common

The MSPXXX-01 circuit contains 5, 7, 8* or 9 nominally equal resistors, each connected between a common pin (Pin No. 1) and a discrete P.C. board pin. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Gate Pull-up
- TTL Input Pull-down
- * Available in "A" profile only
- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- TTL Unused Gate Pull-up

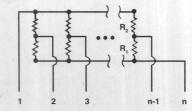
03 Schematic



3, 4 or 5 isolated resistors

The MSPXXX-03 circuit contains 3, 4 or 5 resistors of nominally equal value in a compact package. Each resistor is connected to two discrete P.C. pins.

05 Schematic



Pulse squaring and TTL dual-line terminators

The MSPXXX-05 circuits contain 4, 6, 7* or 8 series pairs of resistors. Each series pair is connected between two common lines. The junction of these resistor pairs is connected to the input terminals.

The 05 circuits are designed for TTL dual-line termination and pulse squaring.

* Available in "A" profile only

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 2.2 Megohm standard. **Tolerance:** 01 and 03 schematic: \pm 2% standard. \pm 1%, \pm 5%, \pm 10% and \pm 20% available.

05 schematic: \pm 2% standard. \pm 5% available. **Temperature Coefficient:** (- 55°C to + 125°C)

± 100PPM/°C typical.

Temperature Coefficient of R Tracking: (- 55°C to + 125°C)

01 and 03 schematic: 50PPM/°C maximum. 05 schematic: 150PPM/°C standard.

(Tighter tracking available.)

Isolation Resistance: 03 schematic: > 100 Megohm.

Resistor Power Rating: (Maximum at 25°C) See derating curve.

Resistor Power Rating: (Maximum at 70°C)

I TOOIOTOI I	OWOI HULLING. (IVI	axiiii at 10
Schemat	ic "A" Profile	"C" Profile
01	.20 watt	.25 watt
03	.30 watt	.40 watt
05	.20 watt	.25 watt

Package Power Rating: (Maximum at 25°C and 70°C) See derating curve.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 100 VDC.

Operating Temperature Range: - 55°C to + 125°C. Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing per MIL-STD-202, Method 215.

Solderability: Per MIL-STD-202, Method 208E.

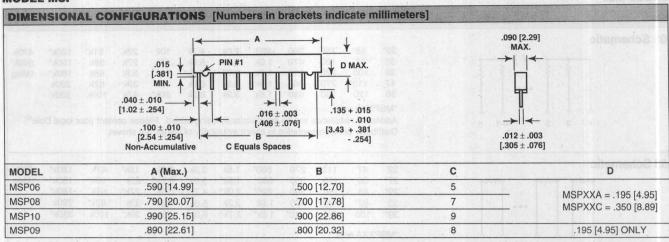
Body: Molded epoxy.

Terminals: Copper alloy, tin-lead plated.

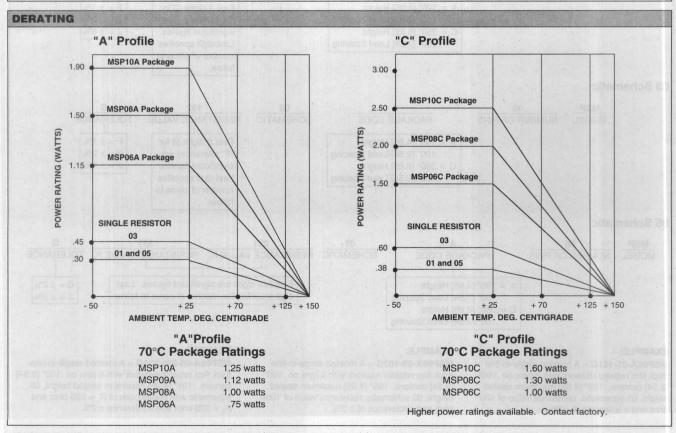
Weight: MSP06A = 0.4 gram MSP06C = 0.7 gram MSP08A = 0.5 gram MSP08C = 0.9 gram

MSP09A = .55 gram MSP10C = 1.1 gram

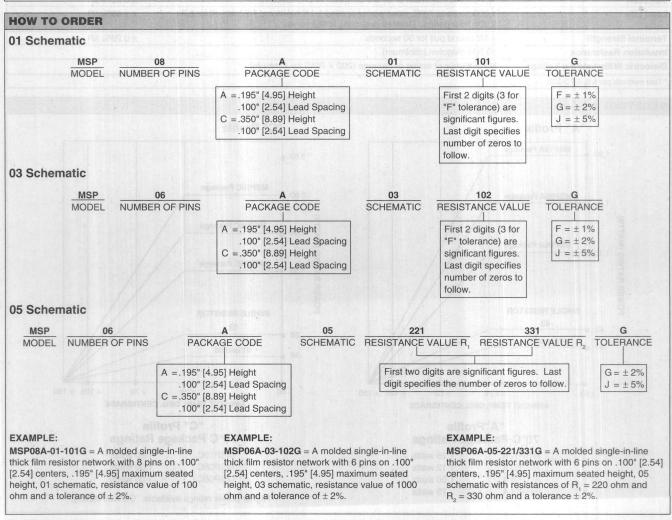
MSP10A = 0.6 gram



ENVIRONMENTAL PERFORMANCE *								
TEST	CONDITIONS	MAX. AR (Typical Test Lot						
Power Conditioning	1 1/2 x rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours ± 4 hours at 25°C ambient temperature	± 0.50% ΔR						
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR						
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR						
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR						
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR						
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of device body for 3 seconds	± 0.25% ΔR						
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR						
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR						
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve.	± 1.00% ΔR						
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR						
Insulation Resistance	10,000 Megohm (minimum)							
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)							
* Test methods per MIL-STD-202.								



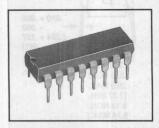
1 2 3 4 n-1 n	Additional resistance values are constantly being added. Please contact your local Dale Distributor or Representative to check availability of values not shown.								
05 Schematic	R ₁ /R ₂	Zo	R ₁ /R ₂	Zo leilined tea					
*	220/270	121	330/470	194					
R, E	180/390	123	330/680	222					
94 (195)	220/330	132	1.5k/3.3k	1031					
1 12 3 n-1 n	330/390	179	porte & hateloil	330					



MODELS MDP14, MDP16, MDP18 Thick Film Resistor Networks

Dual-In-Line, Molded 01, 03, 05 Schematics

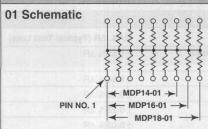




FEATURES

- . 160" [4.06] maximum seated height
- · Rugged, molded case construction
- · Highly stable thick film
- Low temperature coefficient (- 55°C to + 125°C) ± 100PPM/°C
- · Reduces total assembly costs
- · Compatible with automatic inserting equipment
- · Wide resistance range
- Uniform performance characteristics
- Available in tube pack

CIRCUIT APPLICATIONS

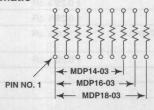


13, 15 or 17 resistors with one pin common

The MDPXX-01 circuit provides a choice of 13, 15 or 17 nominally equal resistors, each connected between a common pin (14, 16 or 18) and a discrete P.C. board pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up
- TTL Input Pull-down
- · Digital Pulse Squaring
- TTL Unused Gate Pull-up
- High Speed Parallel Pull-up

03 Schematic

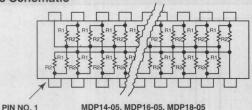


7, 8 or 9 isolated resistors

The MDPXX-03 provides a choice of 7, 8 or 9 nominally equal resistors, each resistor isolated from all others and wired directly across. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Powergate Pull-up
- Line Termination
- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



TTL dual-line terminator; pulse squaring

The MDPXX-05 circuit contains 12, 14 or 16 series pairs of resistors. Each series pair is connected between ground and a common line. The junction of these resistor pairs is connected to the input terminals. The 05 circuits are designed for TTL dual-line termination and pulse squaring.

ELECTRICAL SPECIFICATIONS

Resistance Range:

01 and 03 schematics: 10 ohm to 2.2 Megohm standard.

Tolerance:

01 and 03 schematic: \pm 2% standard. \pm 1% and \pm 5% available.

05 schematic: \pm 2% standard. \pm 1% and \pm 5% available.

Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.

Temperature Coefficient of T.C. Tracking:

(- 55°C to + 125°C)

01 and 03 schematics: ±50PPM/°C. 05 schematic: ±150PPM/°C standard.

(Tighter tracking available).

Resistor Power Rating: (Maximum at 25°C)

See derating curve.

Resistor Power Rating: (Maximum at 70°C)

01 and 05 schematics = .125 watt. 03 schematic = .250 watt.

Package Power Rating: (Maximum at 25°C and 70°C)

See derating curve.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 100 VDC.

Operating Temperature Range: - 55°C to + 125°C. Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing

per MIL-STD-202, Method 215.

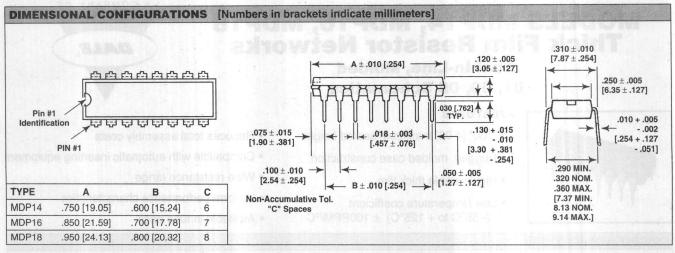
Solderability: Per MIL-STD-202, Method 208E.

Body: Molded epoxy.

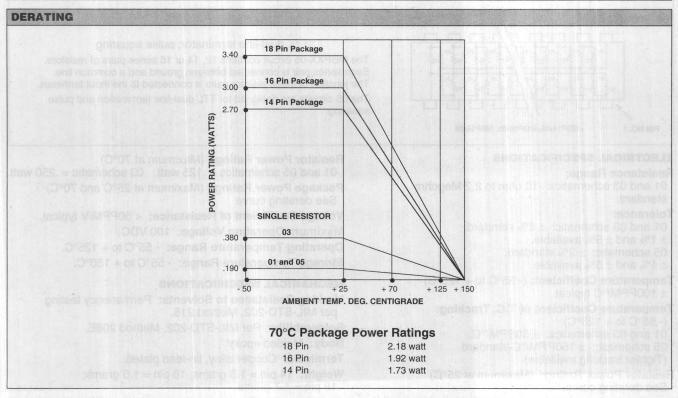
Terminals: Copper alloy, tin-lead plated.

Weight: 14 pin = 1.3 grams; 16 pin = 1.5 grams;

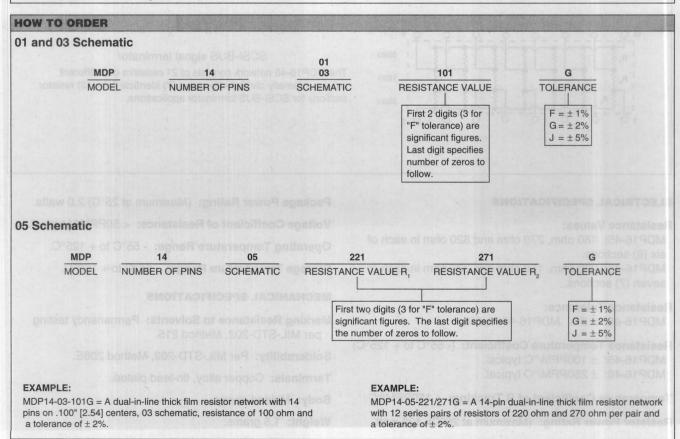
18 pin = 1.7 grams.



ENVIRONMENTAL PERFORMANCE *							
TEST upo wilatimon TT no BT .ET	CONDITIONS	MAX. ∆R (Typical Test Lots)					
Power Conditioning	1 1/2 rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours \pm 4 hours at 25°C ambient temperature	± 0.50% ΔR					
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR					
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR					
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR					
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.05% ΔR					
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of device body for 3 seconds	± 0.25% ΔR					
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR					
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR					
Load Life Page 10 Mossib beni	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve.	± 1.00% ΔR					
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR					
Insulation Resistance	10,000 Megohm (minimum)						
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 VRMS for 1 minute)						
* Test methods per MIL-STD-202.	Wilesan State Common and American State Comm						



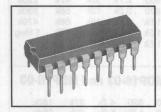
STOCKED RESISTANCE VA	LUES II	N OH	MS ("G" T	olera	nce)	*									
01 Schematic				Mod	el MC)P14-	01		iae	Mc	odels	MD	P16-0)1 and	d MDP	18-01
	22 27 33 39 47 51 56 68	75 82 91 100 120 130 150 160	180 200 220 240 270 330 390 470	510 560 620 680 820 1.0k 1.2k 1.3k	1.5k 1.6k 1.8k 2.0k 2.2k 2.4k 2.7k 3.0k	3.3k 3.9k 4.7k 5.1k 5.6k 6.0k 6.8k 7.5k	8.2k 9.1k 10k 11k 12k 15k 18k 20k	22k 27k 33k 39k 47k 56k 68k 82k	100k 120k 150k 180k 220k 330k 470k 1Meg	22 33 39 47 56 68 82 100	110 120 150 180 220 270 330 390	470 510 560 680 820 1.0 1.2	2.0 2.2 2.7 3.3 3.9 4 4.7	k 6.81 k 8.21 k 104 k 124 k 154 k 184	33k 39k 47k 56k 68k 82k	150k 180k 220k 330k 470k 1 Me
03 Schematic	74 P	Delivie C	1908	Mod	lel MI	DP14	-03	9000 9900	45: ±1	M	odels	MD	P16-	03 an	d MDF	18-03
	22 24 27 30 33 36 39 43 47 51	56 62 68 75 82 91 100 110 120 130	150 160 180 200 220 240 270 300 330 360	390 430 470 510 560 620 680 750 820 910	1.0k 1.1k 1.2k 1.3k 1.5k 1.6k 1.8k 2.0k 2.2k 2.4k	2.7k 3.0k 3.3k 3.6k 3.9k 4.3k 4.7k 5.1k 5.6k 6.0k	6.2k 6.8k 7.5k 8.2k 9.1k 10k 11k 12k 13k	16k 18k 20k 22k 27k 33k 39k 47k 56k 68k	82k 100k 120k 150k 180k 220k 330k 470k 1Meg		33 39 47 56 62 68 82 100	120 150 180 220 270 330 390 470 560 680	820 1.0k 1.2k 1.5k 1.8k 2.0k 2.2k 2.7k 3.3k 3.9k	18k	27k 33k 39k 47k 56k 68k 82k 100k 120k 150k	180k 220k 330k 470k 680k 1 Meg
05 Schematic					lani.		Mode	els M	DP14-0	5, MD	P16-	05 /	ND I	IDP1	8-05	
	4 Pu	Ţſ	1		VALU	JE			Zo	H	VAL	UE	4	14	Zo	
R1 R1 R1 R1 R2 R2 R2 R2	R1 R1	R1 R2 R2	*		180/3	390			123		330/4	470	1		194	
R1 R	R1 R1	RI			220/2	270			121		330/	680	10		222	
			4		220/3	330			132		1.5k/	3.3k			1.03k	
					330/3	390			179		143					



MODELS MDP16-45 and MDP16-46 Thick Film Resistor Networks

Dual-In-Line, Molded



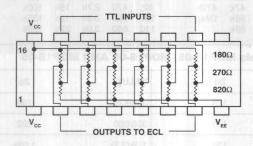


FEATURES

- .190" [4.83] maximum seated height
- · Rugged, molded case construction
- Low temperature coefficient (- 55°C to + 125°C)
 MDP16-45: ± 100PPM/°C, MDP16-46: ± 250PPM/°C
- · Compatible with automatic insertion equipment
- · Highly stable thick film
- · Reduces P.C. board space
- Available in tube pack
- · Reduces total assembly costs

CIRCUIT APPLICATIONS

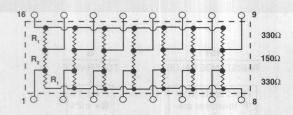
MDP16-45 Schematic



TTL to ECL translator

The MDP16-45 network consists of 18 resistors of 3 different values, internally divided into six (6) identical three (3) resistor sections for TTL to ECL translation.

MDP16-46 Schematic



SCSI-BUS signal terminator

The MDP16-46 network consists of 21 resistors of 2 different values, internally divided into seven (7) identical three (3) resistor sections for SCSI-BUS terminator applications.

ELECTRICAL SPECIFICATIONS

Resistance Values:

MDP16-45: 180 ohm, 270 ohm and 820 ohm in each of six (6) sections.

MDP16-46: 330 ohm, 150 ohm and 330 ohm in each of seven (7) sections.

Resistance Tolerance:

MDP16-45: ± 2%. MDP16-46: ± 5%.

Resistance Temperature Coefficient: (- 55°C to + 125°C)

MDP16-45: \pm 100PPM/°C typical. MDP16-46: \pm 250PPM/°C typical.

Temperature Coefficient of R Tracking: ± 150PPM/°C.

Resistor Power Rating: (Maximum at 25°C) .125 watt.

Package Power Rating: (Maximum at 25°C) 2.0 watts.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Operating Temperature Range: - 55°C to + 125°C.

Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing

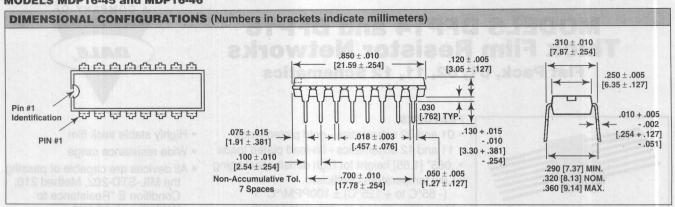
per MIL-STD-202, Method 215.

Solderability: Per MIL-STD-202, Method 208E.

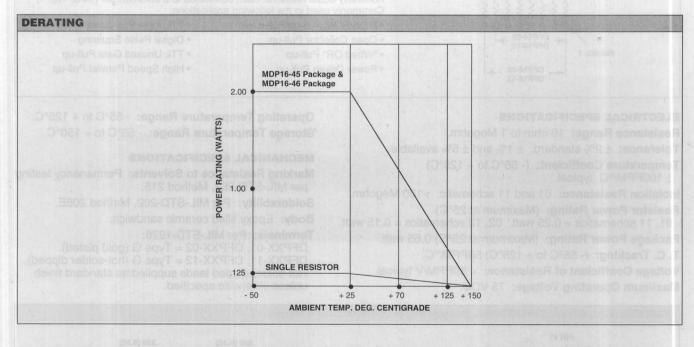
Terminals: Copper alloy, tin-lead plated.

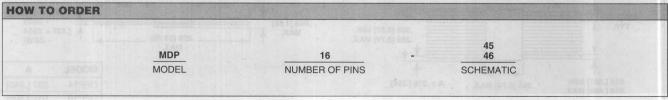
Body: Molded epoxy.

Weight: 1.5 grams.



TEST	CONDITIONS	MAX. △R (Typical Test Lots			
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR			
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR			
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR			
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR			
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR			
Shock maring GBJ+	Total of 18 shocks at 100 G's	± 0.25% ΔR			
Vibration Washing House	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR			
Load Life Myor-august 1977	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve	± 0.50% ΔR			
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR			
Insulation Resistance	10,000 Megohm (minimum)	2, 12 Schematio			
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)				

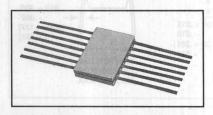




MODELS DFP14 and DFP16 Thick Film Resistor Networks

Flat Pack, 01, 02, 11, 12 Schematics



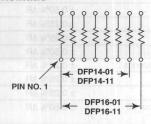


FEATURES

- 01 and 02 schematics gold plated leads
- 11 and 12 schematics tin-lead plated leads
- .065" [1.65] height for high density packaging
- Low temperature coefficient
 (-55°C to + 125°C) ± 100PPM/°C
- Hot-solder dipped or gold-plated leads
- · Highly stable thick film
- · Wide resistance range
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test

CIRCUIT APPLICATIONS

01, 11 Schematic



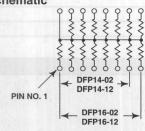
7 or 8 isolated resistors

The DFPXX-01and DFPXX-11 provide the user with 7 or 8 nominally equal resistors with each resistor isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination

- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

02, 12 Schematic



13 or 15 resistors with one pin common

The DFPXX-02 and DFPXX-12 provide the user with a choice of 13 or 15 nominally equal resistors, each connected to a common pin (14 or 16). Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up
- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
- High Speed Parallel Pull-up

ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm.

Tolerance: \pm 2% standard. \pm 1% and \pm 5% available.

Temperature Coefficient: (- 55°C to + 125°C)

± 100PPM/°C typical.

Isolation Resistance: 01 and 11 schematic: >100 Megohm.

Resistor Power Rating: (Maximum at 25°C)

01, 11 schematics = 0.25 watt. 02, 12 schematics = 0.15 watt.

Package Power Rating: (Maximum at 25°C) 0.65 watt.

T. C. Tracking: (-55°C to + 125°C) 50PPM/°C.

Voltage Coefficient of Resistance: < 50PPM/V typical.

Maximum Operating Voltage: 75 VDC.

Operating Temperature Range: - 55°C to + 125°C. Storage Temperature Range: - 55°C to + 150°C.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing

per MIL-STD-202, Method 215.

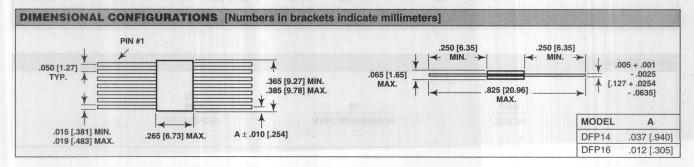
Solderability: Per MIL-STD-202, Method 208E.

Body: Epoxy filled ceramic sandwich.

Terminals: Per MIL-STD-1276:

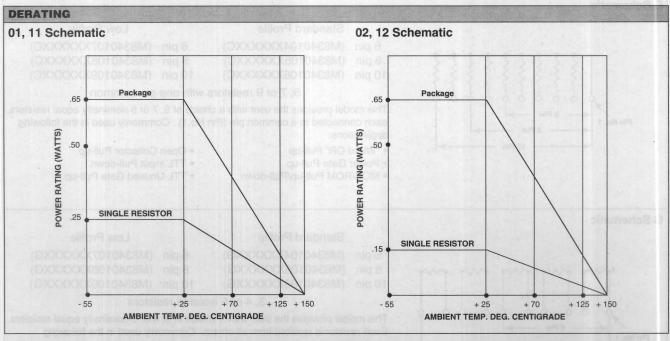
DFPXX-01, DFPXX-02 = Type G (gold plated). DFPXX-11, DFPXX-12 = Type G (hot-solder dipped). Hot-solder dipped leads supplied as standard finish

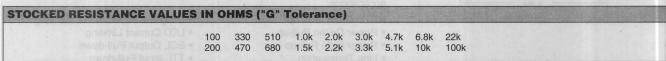
unless otherwise specified.

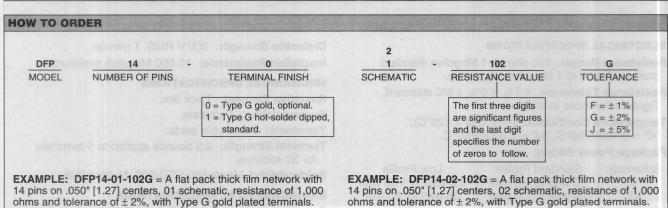


MODELS DFP14 and DFP16

ENVIRONMENTAL PERFORM	IANCE *	The state of the s
TEST	CONDITIONS	MAX. ∆R (Typical Test Lots)
Power Conditioning	1 1/2 x rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours \pm 4 hours at 25°C ambient temperature	± 0.50% ΔR
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve	± 0.50% ΔR
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR
Insulation Resistance	10,000 Megohm (minimum)	
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)	
* Test methods per MIL-STD-202.		





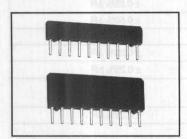


DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

M83401/04, 05, 06, 07, 08, 09 Thick Film Resistor Networks

Military, MIL-R-83401 Qualified Single-In-Line Package, C & G Schematics



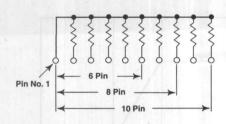


FEATURES

- .36 watt to 1.8 watt at 70°C
- Qualified to MIL-R-83401
- Designed for automatic insertion
- Withstands thermal stress from - 65°C to +125°C
- · Conforms to IC package configurations
- · High temperature solder joints
- Techno's capabilities include designing special resistor networks from customer supplied schematics. We welcome the opportunity to work with customer engineers during the initial design phase.

CIRCUIT APPLICATIONS

C Schematic



Standard Profile

6 pin (M8340104XXXXXXC) 6 8 pin (M8340105XXXXXXC) 8 10 pin (M8340106XXXXXXC) 10 Low Profile

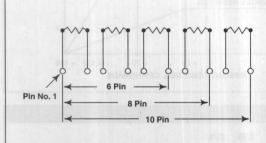
6 pin (M8340107XXXXXXC) 8 pin (M8340108XXXXXXC) 10 pin (M8340109XXXXXXC)

5. 7 or 9 resistors with one pin common

This model provides the user with a choice of 5, 7 or 9 nominally equal resistors, each connected to a common pin (Pin No.1). Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Gate Pull-up
- MOS/ROM Pull-up/Pull-down
- · Open Collector Pull-up
- TTL Input Pull-down
- TTL Unused Gate Pull-up

G Schematic



Standard Profile

6 pin (M8340104XXXXXXG) 8 pin (M8340105XXXXXXG) 10 pin (M8340106XXXXXXG)

Low Profile

6 pin (M8340107XXXXXXG) 8 pin (M8340108XXXXXXG) 10 pin (M8340109XXXXXXG)

3, 4 or 5 isolated resistors

This model provides the user with a choice of 3, 4 or 5 nominally equal resistors. Each resistor is isolated from all others. Commonly used in the following applications:

- · "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination
- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

ELECTRICAL SPECIFICATIONS

Resistance Range: 100 ohm to 1 Megohm standard

profile, 27 ohm to 1 Megohm low profile.

Resistance Tolerance: \pm 1%, \pm 2%, \pm 5% standard.

Tighter tolerances available.

Temperature Coefficient: $(-65^{\circ}\text{C to} + 125^{\circ}\text{C})$ "K" = $\pm 100\text{PPM/°C}$, "M" = $\pm 300\text{PPM/°C}$.

Package Power Rating:

Schematic Standard Profile Lo
C 1.0 watt to 1.8 watt 0.6 wat
G 0.6 watt to 1.0 watt .36 wa

Low Profile
0.6 watt to 1.08 watt
.36 watt to .60 watt

Maximum Operating Voltage: 50 volts per resistor.

Dielectric Strength: 200 V RMS, 1 minute.

Insulation Resistance: 10,000 Megohm minimum.

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film. Encapsulation: Phthalate. Terminals: Solderable leads.

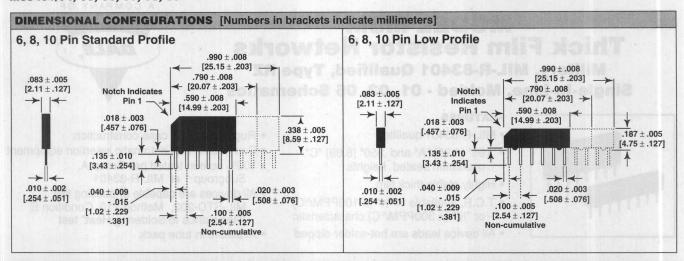
Terminal Strength: 4.5 pounds applied to 5 terminals

for 30 seconds.

Solderability: Meets MIL-STD-202, Method 208.

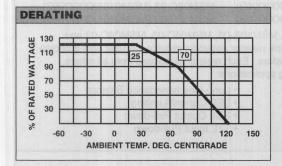
ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 125°C.



TEST 1		CONDITIONS	MIL-R-83401 REQUIREMENT ³	TYPICAL AR
Power Conditioning	(108)	100 hours at 1.5 times rated power at 25°C, 90"/30" cycle	Group A Combined	ΔR < 0.10%
Thermal Shock	(107)	5 cycles, - 65°C to + 125°C	$\Delta R \leq 0.70\%^2$	
Thermal Shock Group C	(107)	25 cycles, - 65°C to + 125°C	$\Delta R \leq 0.70\%^2$	ΔR < 0.10%
Short Time Overload	W19C-01	2.5 times rated voltage not to exceed 2 times rated power for 5 seconds	$\Delta R \le 0.25\%^2$	ΔR < 0.02%
Low Temperature Storage	O-DOUME	24 hours, no load at - 65°C	$\Delta R \leq 0.25\%^2$	ΔR < 0.02%
Low Temperature Operation	nevery son	1 hour storage, 45 minutes rated power at - 65°C	$\Delta R \leq 0.25\%^2$	ΔR < 0.02%
High Temperature Exposure	0,02,000,00	100 hours, no load at 125°C	$\Delta R \leq 0.50\%^2$	ΔR < 0.06%
Moisture Resistance	(106)	240 hours with humidity ranging from 80% RH to 98% RH	$\Delta R \leq 0.50\%^2$	ΔR < 0.20%
Resistance to Soldering Heat	(210)	350° for 3 seconds	$\Delta R \leq 0.25\%^2$	ΔR < 0.05%
Shock	(213)	18 shocks, 100 g, 6 ms, sawtooth, 3 axes	$\Delta R \leq 0.25\%^2$	ΔR < 0.04%
Vibration	(204)	10 to 2000 Hz, 20 g, 12 hours, 3 axes	$\Delta R \leq 0.25\%^2$	ΔR < 0.04%
Load Life	(108)	1000 hours at rated power at 75°C and at rated power at 25°C, 90"/30" cycle	$\Delta R \le 0.50\%^2$	ΔR < 0.20%

- 1. Numbers in parenthesis refer to test method of MIL-STD-202 as modified by the detail specification.
- 2. For values below 100 ohm, add 0.05 ohm to the allowable change.
 3. The referenced tests also require that setting stability change shall not exceed ± 0.05 percent plus the specified maximum resolution.



POWER RATING

The power rating listed for each network is based on continuous full-load operation at an ambient temperature of 70°C. When the network is operated at temperatures other than 70° C, the power rating should be scaled linearly as shown.

PART MARKING

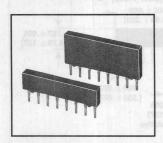
- Complete part number
- Resistance value
- Tolerance value
- Manufacturer's name or code
- Date code
- Pin indentifier

M83401	06	K M	1003	F	C
MILITARY SPECIFICATION NO.	SIZE	CHARACTERISTIC	VALUE	TOLERANCE	SCHEMATIC
ic-os (Masach osxocoxxi) sc-os, MsMosc-os and provide the user with a choice using and TTL bust-line		K = ± 100PPM/°C M = ± 300PPM/°C	First three digits are significant figures. Last digit specifies number of zeros. Use R as decimal point for value less than 100 ohm.	F = ± 1% G = ± 2% J = ± 5%	
AMPLE: 340106M1003FC = A single-in	-line resistor network with 10 pi	ns,	Example: $30R0 = 30\Omega$.		

MODEL MSM Thick Film Resistor Networks

Military, MIL-R-83401 Qualified, Type RZ Single-In-Line, Molded - 01, 03, 05 Schematics



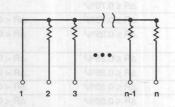


FEATURES

- MIL-R-83401 qualified
- .195" [4.95] "A" and .350" [8.89] "C" maximum seated heights
- · Highly stable thick film
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) characteristic
- · All device leads are hot-solder dipped
- Rugged molded case construction
- Compatible with automatic insertion equipment
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test
- · Available in tube pack

CIRCUIT APPLICATION

01 Schematic



5, 7 or 9 resistors with one pin common

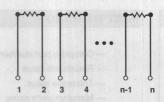
"A" Profile

MSM06A-01 (M8340107XXXXXXC) MSM08A-01 (M8340108XXXXXXC) MSM10A-01 (M8340109XXXXXXC) "C" Profile
MSM06C-01 (M8340104XXXXXXC)
MSM08C-01 (M8340105XXXXXXC)
MSM10C-01 (M8340106XXXXXXXC)

The MSM06A-01, MSM08A-01, MSM10A-01, MSM06C-01, MSM08C-01 and MSM10C-01 molded single-in-line resistor networks provide the user with a choice of 5, 7 or 9 nominally equal resistors, each connected to a common pin (Pin No. 1). Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Gate Pull-up
- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- TTL Input Pull-down
- TTL Unused Gate Pull-up

03 Schematic



3, 4 or 5 isolated resistors

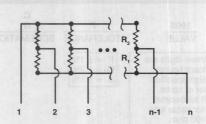
"A" Profile

MSM06A-03 (M8340107XXXXXXG) MSM08A-03 (M8340108XXXXXXG) MSM10A-03 (M8340109XXXXXXG) "C" Profile
MSM06C-03 (M8340104XXXXXXG)
MSM08C-03 (M8340105XXXXXXG)
MSM10C-03 (M8340106XXXXXXG)

The MSM06A-03, MSM08A-03, MSM10A-03, MSM06C-03, MSM08C-03 and MSM10C-03 molded single-in-line resistor networks provide the user with a choice of 3, 4 or 5 nominally equal resistors. Each resistor is isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination
- Long-Line Impedance Balance
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



4, 6 or 8 isolated resistors

"A" Profile MSM06A-05 (M8340107XXXXXH) MSM08A-05 (M8340108XXXXXXH) MSM10A-05 (M8340109XXXXXXH) "C" Profile
MSM06C-05 (M8340104XXXXXXH)
MSM08C-05 (M8340105XXXXXXH)
MSM10C-05 (M8340106XXXXXXXH)

The MSM06A-05, MSM08A-05, MSM10A-05, MSM06C-05, MSM08C-05 and MSM10C-05 molded single-in-line resistor networks provide the user with a choice of 4, 6 or 8 pairs of $\rm R_1/R_2$ resistor values for pulse squaring and TTL dual-line terminating requirements.

MODEL MSM

ELECTRICAL SPECIFICATIONS

Resistance Range: 01 and 03 schematics:

10 ohm to 1 Megohm. 05 schematic: See values in table.

Tolerance: \pm 2% standard. \pm 1% and \pm 5% available.

Temperature Coefficient: $(-55^{\circ}\text{C to} + 125^{\circ}\text{C})$ "K" = $\pm 100\text{PPM/}^{\circ}\text{C}$, "M" = $\pm 300\text{PPM/}^{\circ}\text{C}$.

Resistor Power Rating: (Maximum at 70°C .2 watt)
MSMXXA-01, MSMXXC-01 and MSMXXC-03 = .2 watt
MSMXXA-03 = .12 watt
MSMXXC-05 = .11 watt

MSMXXA-05 = .07 watt

Package Power Rating: (Maximum at 70°C)

MSM06A-01 = .60 watt

MSM08A-01 = .84 watt

MSM08A-01 = 1.08 watt

MSM08A-03 = .36 watt

MSM08A-03 = .48 watt

MSM10A-01 = 1.08 watt

MSM06C-01 = 1.00 watt

MSM06C-03 = .60 watt

MSM08C-01 = 1.40 watt

MSM08C-03 = .80 watt

MSM10C-03 = 1.00 watt

MSM06A-05 = .56 watt MSM08A-05 = .84 watt MSM10A-05 = 1.12 watt MSM06C-05 = .88 watt MSM08C-05 = 1.32 watt MSM10C-05 = 1.76 watt

Maximum Operating Voltage: 50 VDC.

Operating Temperature Range: - 55°C to + 125°C.

MECHANICAL SPECIFICATIONS

Body: Molded epoxy.

Terminals: Copper alloy, hot-solder dipped.

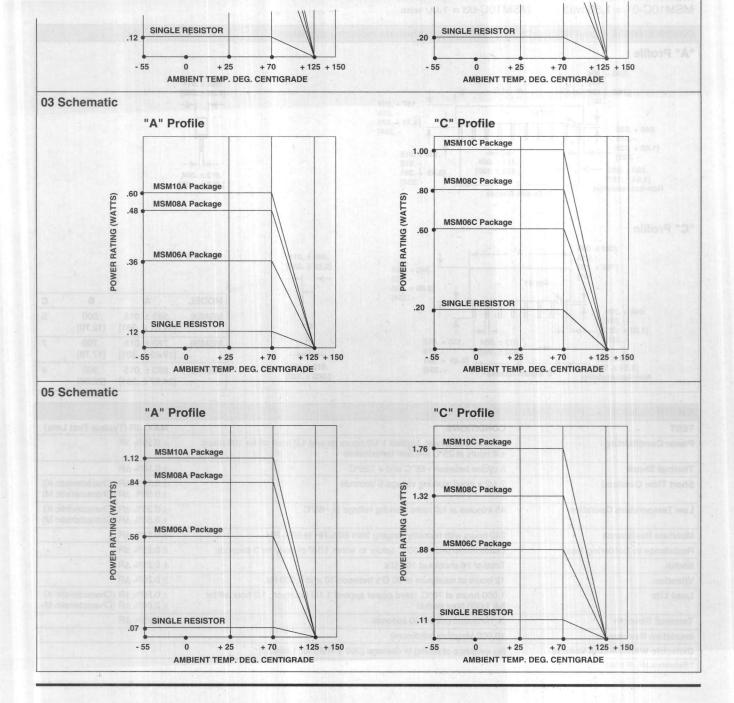
Solderability: Per MIL-R-83401.

Weight:

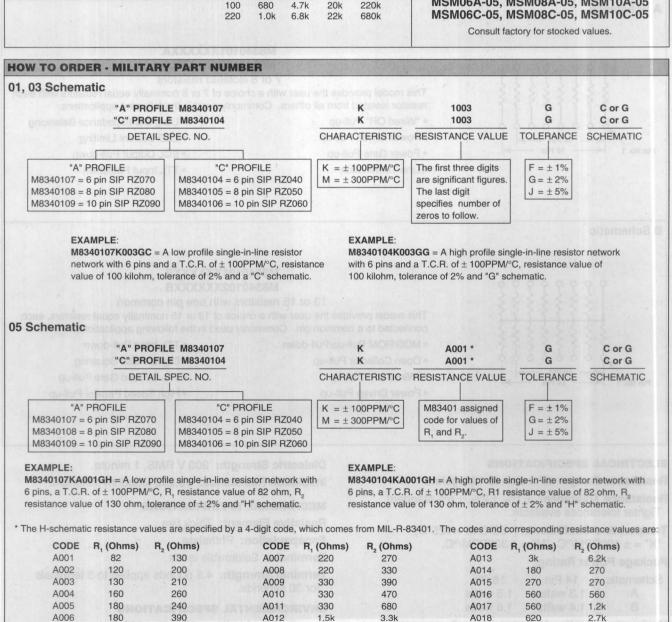
"A" Profile "C" Profile
6 pin = .4 gram 6 pin = .7 gram
8 pin = .5 gram 8 pin = .9 gram
10 pin = .6 gram 10 pin = 1.1 gram

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] "A" Profile .030 + .005- .015 $.089 \pm .014$ [2.26 $\pm .356$] [.762 + .127]- .3811 .187 + .008 PIN #1 - .010 [4.75 + .203].040 + .009 .254] - .015 [1.02 + .229]135 + .015 - .381] .017 ± .004 - .010 .100 ± .005 $[.432 \pm .102]$ + .381 .012 ± .004 [2.54 ± .127] - .254] B [.305 ± .102] Non-Accumulative C Equals Spaces "C" Profile .030 + .005- .015 [762 + .127 $.089 \pm .014$ [2.26 ± .356] .342 + .008 - .010 PIN #1 [8.69 + .203 - .254] MODEL A B C .040 + .009MSM06 .583 ± .015 .500 5 - .015 [14.81 ± .381] [12.70] [1.02 + .229]- .3811 .017 ± .004 .135 + .015 $.783 \pm .015$.700 MSM08 7 - .010 + .381 $[.432 \pm .102]$ $[19.89 \pm .381]$ [17.78] $.100 \pm .005$ [3.43 [2.54 ± .127] .012 ± .004 - .254] MSM10 .983 ± .015 .900 9 C Equals Spaces Non-Accumulative $[.305 \pm .102]$ $[24.97 \pm .381]$ [22.86]

ENVIRONMENTAL PERFORM	MANGE "	经济是是国际的国际的企业的
TEST	CONDITIONS	MAX. △R (Typical Test Lots)
Power Conditioning	1 1/2 x rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours \pm 4 hours at 25°C ambient temperature	± 0.50% ΔR
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR (Characteristic K) ± 0.50% ΔR (Characteristic M)
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR (Characteristic K) ± 0.50% ΔR (Characteristic M)
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period	± 0.50% ΔR (Characteristic K) ± 2.00% ΔR (Characteristic M)
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR
Insulation Resistance	10,000 Megohm (minimum)	
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)	10 mg 20 mg
* Reference MIL-R-83401.	PART THE STATE OF	



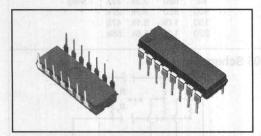
STOCKED RESISTANCE VALUES IN OHMS ("G TOLERANCE) 01 Schematic MSM06C-01, MSM08C-01, MSM10C-01 1.5k 6.8k 82k 39 2.0k 8.2k 100k MSM06A-01, MSM08A-01, MSM10A-01 470 2.2k 47 510 10k 220k 1.0k 4.7k 10k 100k 1Meg 68 560 2.7k 15k 470k 3.3k 5.6k 510 22k 470k 82 680 3.3k 22k 1 Meg 100 820 4.7k 27k 2 3 n-1 5.1k 47k 150 1.0k 220 1.2k 5.6k 56k 03 Schematic 05 Schematic MSM06A-03, MSM08A-03, MSM10A-03 100 1.0k 10k 100k MSM06C-03, MSM08C-03, MSM10C-03 3.3k n-1 n MSM06A-05, MSM08A-05, MSM10A-05 100 680 4.7k 20k 220k MSM06C-05, MSM08C-05, MSM10C-05 220 1.0k 6.8k 22k 680k Consult factory for stocked values.



M8340101 and M8340102 **Thick Film Resistor Networks**

Military, MIL-R-83401 Qualified **Dual-In-Line Package, A and B Schematics**



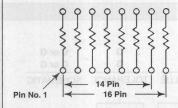


FEATURES

- 1.3 watt to 1.6 watt at 70°C
- Qualified to MIL-R-83401
- · Designed for automatic insertion
- Withstands thermal stress from - 65°C to +125°C
- Conforms to IC package configurations
- · High temperature solder joints
- Techno's capabilities include designing special resistor networks from customer supplied schematics. We welcome the opportunity to work with customer engineers during the initial design phase.

CIRCUIT APPLICATIONS

A Schematic



M8340101XXXXXXA M8340102XXXXXXA

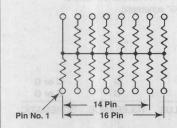
7 or 8 isolated resistors

This model provides the user with a choice of 7 or 8 nominally equal resistors with each resistor isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- · Power Gate Pull-up
- Line Termination

- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

B Schematic



M8340101XXXXXXB M8340102XXXXXXB

13 or 15 resistors with one pin common

This model provides the user with a choice of 13 or 15 nominally equal resistors, each connected to a common pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up

- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
 - High Speed Parallel Pull-up

ELECTRICAL SPECIFICATIONS

Resistance Range: 27.0 ohm to 1 Megohm.

Resistance Tolerance: $\pm 1\%$, $\pm 2\%$, $\pm 5\%$ standard.

Tighter tolerances available.

Temperature Coefficient: (- 65°C to + 125°C) "K" = ± 100 PPM/°C, "M" = ± 300 PPM/°C.

Package Power Rating:

Schematic

14 Pin

16 Pin

1.3 watts

1.5 watts

В

1.4 watts

1.6 watts

Maximum Operating Voltage: 100 volts per resistor.

Dielectric Strength: 200 V RMS, 1 minute.

Insulation Resistance: 10,000 Megohm minimum.

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film.

Encapsulation: Phthalate.

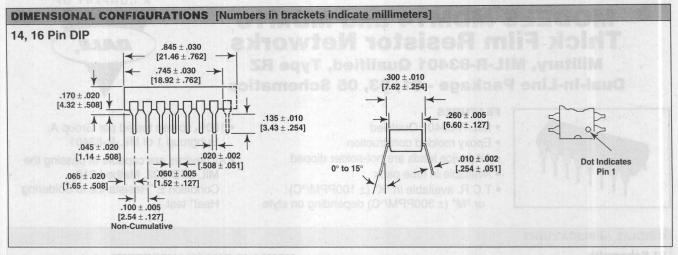
Terminals: Solderable leads.

Terminal Strength: 4.5 pounds applied to 5 terminals

for 30 seconds.

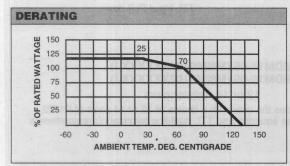
ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: -65°C to + 125°C.



ENVIRONMENTAL PER	FORMA	NCE		
TEST 1	one pin	CONDITIONS	MIL-R-83401 REQUIREMENT ³	MAX. ∆R (Typical Test Lots)
Power Conditioning	(108)	100 hours at 1.5 times rated power at 25°C, 90"/30" cycle	Group A Combined	ΔR < 0.10%
Thermal Shock	(107)	5 cycles, - 65°C to + 125°C	$\Delta R \leq 0.70\%^2$	
Thermal Shock Group C	(107)	25 cycles, - 65°C to + 125°C	$\Delta R \le 0.70\%^2$	ΔR < 0.10%
Short Time Overload	lu'9 Istipil	2.5 times rated voltage not to exceed 2 times rated power for 5 seconds	$\Delta R \le 0.25\%^2$	ΔR < 0.02%
Low Temperature Storage		24 hours, no load at - 65°C	ΔR ≤ 0.25%²	ΔR < 0.02%
Low Temperature Operation		1 hour storage, 45 minutes rated power at - 65°C	$\Delta R \le 0.25\%^2$	ΔR < 0.02%
High Temperature Exposure	I Street	100 hours, no load at 125°C	$\Delta R \le 0.50\%^2$	ΔR < 0.06%
Moisture Resistance	(106)	240 hours with humidity ranging from 80% RH to 98% RH	$\Delta R \le 0.50\%^2$	ΔR < 0.03%
Resistance to Soldering Heat	(210)	350° for 3 seconds	$\Delta R \le 0.25\%^2$	ΔR < 0.05%
Shock	(213)	18 shocks, 100 g, 6 ms, sawtooth, 3 axes	$\Delta R \le 0.25\%^2$	ΔR < 0.04%
Vibration	(204)	10 to 2000 Hz, 20 g, 12 hours, 3 axes	$\Delta R \le 0.25\%^2$	ΔR < 0.04%
Load Life	(108)	1000 hours at rated power at 75°C and at rated power at 25°C, 90"/30" cycle	$\Delta R \le 0.50\%^2$	ΔR < 0.22%

- Numbers in parenthesis refer to test method of MIL-STD-202 as modified by the detail specification.
 For values below 100 ohm, add 0.05 ohm to the allowable change.
 The referenced tests also require that setting stability change shall not exceed ± 0.05 percent plus the specified maximum resolution.



POWER RATING

The power rating listed for each network is based on continuous full-load operation at an ambient temperature of 70°C. When the network is operated at temperatures other than 70° C, the power rating should be scaled linearly as shown.

PART MARKING

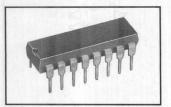
- Complete part number
- Resistance value
- Tolerance value
- Manufacturer's name or code
- Date code
- Pin identifier

M83401	01 02	K M	1003	mrie OF Soil	A B
MILITARY SPECIFICATION NO.	SIZE	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE	SCHEMATIC
	01 = 14 Pin DIP 02 = 16 Pin DIP	K = ± 100PPM/°C M = ± 300PPM/°C	First three digits are significant figures. Last digit specifies number of zeros.	F = ± 1% G = ± 2% J = ± 5%	
EXAMPLE: M8340102M1003FB = A dual-in-line with 16 pins, a T.C.R. of ± 300 PPM/of 100 kilohms, tolerance of 1% and to	C, resistance value		Use R as decimal point for value less than 100 ohm. Example: $30R0 = 30\Omega$.		

MODELS MDM14 and MDM16 Thick Film Resistor Networks

Military, MIL-R-83401 Qualified, Type RZ Dual-In-Line Package - 01, 03, 05 Schematics



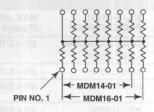


FEATURES

- MIL-R-83401 Qualified
- Epoxy molded construction
- · All device leads are hot-solder dipped
- · Available in tube pack
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) depending on style
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test

CIRCUIT APPLICATIONS

01 Schematic



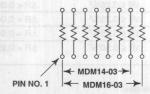
MDM14-01 (M8340101XXXXXXB) MDM16-01 (M8340102XXXXXXB)

13 or 15 resistors with one pin common

The MDMXX-01 provides the user with a choice of 13 or 15 nominally equal resistors, each connected to a common pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up
- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
- High Speed Parallel Pull-up

03 Schematic



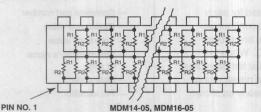
MDM14-03 (M8340101XXXXXXA) MDM16-03 (M8340102XXXXXXA)

7 or 8 isolated resistors

The MDMXX-03 provides the user with a choice of 7 or 8 nominally equal resistors, with each resistor isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination
- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

05 Schematic



MDM14-05 (M8340101XXXXXXJ) MDM16-05 (M8340102XXXXXXJ)

12 or 14 resistor pairs

The MDMXX-05 provides the user with a choice of 12 or 14 pairs of R1/R2 resistor values for pulse squaring and TTL dual-line terminating requirements.

ELECTRICAL SPECIFICATIONS

Resistance Range:

01 and 03 schematics: 10 ohm to 1 Megohm.

05 schematic: See values in table. **Tolerance:** \pm 1%, \pm 2% and \pm 5%.

Temperature Coefficient: (- 55°C to + 125°C)

"K" = ± 100 PPM/°C. "M" = ± 300 PPM/°C.

Maximum Operating Voltage: 100 VDC.

Operating Temperature Range: - 55°C to + 125°C.

Resistor Power Rating: (Maximum at 70°C) 01 schematic = 0.1 watt, 03 schematic = 0.2 watt

05 schematic = 0.05 watt.

Package Power Rating: (Maximum at 70°C)

3	3. /	
Schematic	14 Pin	16 Pin
01	1.30 watts	1.50 watts
03	1.40 watts	1.60 watts
05	1.20 watts	1.40 watts

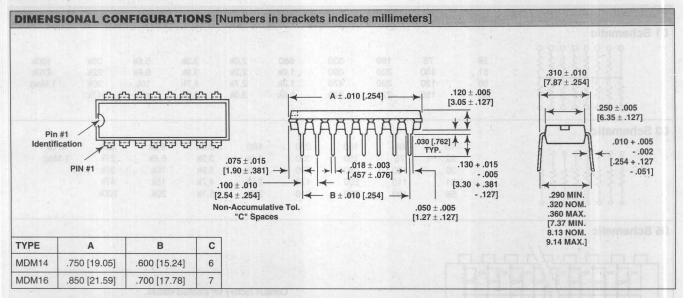
MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing per MIL-R-83401.

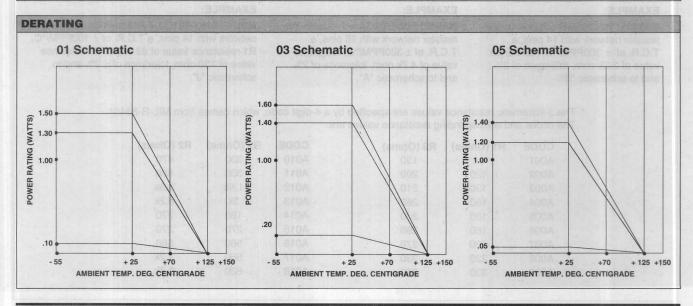
Solderability: Per MIL-R-83401.

Body: Molded epoxy.

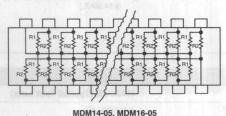
Terminals: Copper alloy, hot-solder dipped.



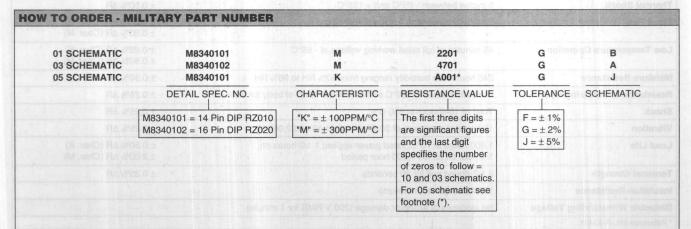
ENVIRONMENTAL PERFORI	MANCE *	
TEST	CONDITIONS	MAX. ∆R (Typical Test Lots)
Power Conditioning	1 1/2 x rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours ± 4 hours at 25°C ambient temperature	± 0.50% ΔR
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR (Char. K) ± 0.50% ΔR (Char. M)
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR (Char. K) ± 0.50% ΔR (Char. M)
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period	± 0.50% ΔR (Char. K) ± 2.00% ΔR (Char. M)
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR
Insulation Resistance	10,000 Megohm (minimum)	
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)	
* Reference MIL-R-83401.		







Consult factory for stocked values.



EXAMPLE:

M8340101M2201GB = A dual-in-line resistor network with 14 pins, a T.C.R. of ± 300PPM/°C, resistance value of 2.2k ohm, tolerance of 2% and to schematic "B".

EXAMPLE:

M8340102M4701GA = A dual-in-line resistor network with 16 pins, a T.C.R. of ± 300PPM/°C, resistance value of 4.7k ohm, tolerance of 2% and to schematic "A".

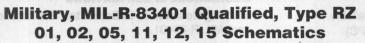
EXAMPLE:

M8340101KA001GJ = A dual-in-line resistor network with 14 pins, a T.C.R. of ± 100PPM/°C, R1 resistance value of 82 ohm, R2 resistance value of 130 ohm, tolerance of ± 2% and to schematic "J".

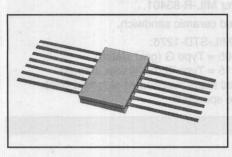
* The J-schematic resistance values are specified by a 4-digit code, which comes from MIL-R-83401. The codes and corresponding resistance values are:

CODE	R1 (Ohms)	R2 (Ohms)	CODE	R1 (Ohms)	R2 (Ohms)
A001	82	130	A010	330	470
A002	120	200	A011	330	680
A003	130	210	A012	1.5k	3.3k
A004	160	260	A013	. 3k	6.2k
A005	180	240	A014	180	270
A006	180	390	A015	270	270
A007	220	270	A016	560	560
A008	220	330	A017	560	1.2k
A009	330	390	A018	620	2.7k

MODEL DFM14 Thick Film Resistor Networks





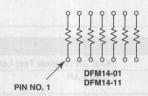


FEATURES

- 01, 02, 05 schematics gold plated leads
- 11, 12, 15 schematics hot solder dipped
- MIL-R-83401 qualified
- · Highly stable thick film
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) characteristic
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- .065" [1.65] height for high density packaging
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test

CIRCUIT APPLICATIONS

01, 11 Schematic



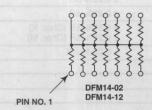
DFM14-01 (M8340103XXXXXXA) DFM14-11 (M8340103XXXXXXA)

7 isolated resistors

The DFM14-01 and DFM14-11 provide the user with 7 nominally equal resistors with each resistor isolated from all others. Commonly used in the following applications:

- "Wired OR" Pull-up
- Power Driven Pull-up
- Power Gate Pull-up
- Line Termination
- Long-line Impedance Balancing
- LED Current Limiting
- ECL Output Pull-down
- TTL Input Pull-down

02, 12 Schematic



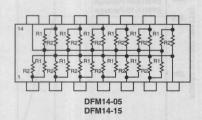
DFM14-02 (M8340103XXXXXXB) DFM14-12 (M8340103XXXXXXB)

13 resistors with one pin common

The DFM14-02 and DFM14-12 provide the user with a choice of 13 nominally equal resistors, each connected to a common pin. Commonly used in the following applications:

- MOS/ROM Pull-up/Pull-down
- Open Collector Pull-up
- "Wired OR" Pull-up
- Power Driven Pull-up
- TTL Input Pull-down
- Digital Pulse Squaring
- TTL Unused Gate Pull-up
- High Speed Parallel Pull-up

05, 15 Schematic



DFM14-05 (M8340103XXXXXXH) DFM14-15 (M8340103XXXXXXH)

12 pairs of resistors

The DFM14-05 and DFM14-15 provide the user with a choice of 12 pairs of R1/R2 resistor values for pulse squaring and TTL dual-line terminating requirements.

MODEL DFM14

ELECTRICAL SPECIFICATIONS

Resistance Range:

01 and 02 schematics: 10 ohm to 1 Megohm.

05 schematic: See values in table.

Tolerance: \pm 2% standard. \pm 1%, \pm 5% available. Temperature Coefficient: (- 55°C to + 125°C) "K" = ± 100 PPM/°C. "M" = ± 300 PPM/°C.

Isolation Resistance: 01, 11 schematic = > 100 Megohm.

Resistor Power Rating: (Maximum at 70°C) 01, 11 schematics = 0.050 watt. 02, 12 schematics =

0.025 watt. 05, 15 schematics = 0.015 watt.

Package Power Rating: (Maximum at 70°C) 01, 11 schematics = 0.350 watt. 02, 12 schematics =

0.325 watt. 05, 15 schematics = 0.350 watt.

Maximum Operating Voltage: 50 VDC.

Operating Temperature Range: - 55°C to + 125°C.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing

per MIL-R-83401.

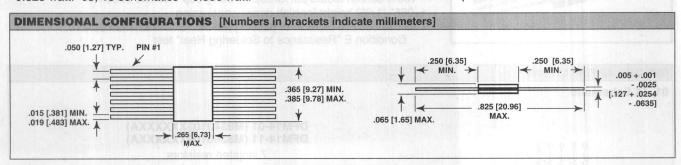
Solderability: Per MIL-R-83401.

Body: Epoxy filled ceramic sandwich.

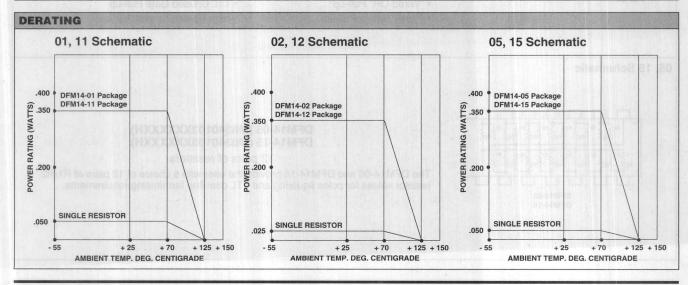
Terminals: Per MIL-STD-1276:

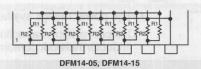
DFM14-01, 02, 05 = Type G (gold plated). DFM14-11, 12, 15 = Type G (hot-solder dipped). Hot-solder dipped leads supplied as standard finish

unless otherwise specified.



ENVIRONMENTAL PERFORM	NANCE *	
TEST principal eonsbegm	CONDITIONS SECTION AND DESIGNATION	MAX. ∆R (Typical Test Lots)
Power Conditioning	1 1/2 x rated power, applied 1 1/2 hours on and 1/2 hour off for 100 hours \pm 4 hours at 25°C ambient temperature	± 0.50% ΔR
Thermal Shock	5 cycles between - 65°C and + 125°C	± 0.50% ΔR
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR (Char. K) ± 0.50% ΔR (Char. M)
Low Temperature Operation	45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR (Char. K) ± 0.50% ΔR (Char. M)
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of body for 3 seconds	± 0.25% ΔR
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period	± 0.50% ΔR (Char. K) ± 0.20% ΔR (Char. M)
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25 % ΔR
Insulation Resistance	10,000 Megohm (minimum)	
Dielectric Withstanding Voltage	No evidence of arcing or damage (200 V RMS for 1 minute)	
* Reference MIL-R-83401.	su a region - Colection and Co	and the second second





HOW TO ORDER - MILITARY PART NUMBER

01, 11 SCHEMATIC 02, 12 SCHEMATIC 05, 15 SCHEMATIC M8340103 M8340103 M8340103

M M K 6801 6801 A001*

RESISTANCE VALUE

G G G TOLERANCE A B J

SCHEMATIC

DETAIL SPEC. NO.

M8340103 = 14 Pin DIP RZ030

"K" = ± 100PPM/°C "M" = ± 300PPM/°C

The first three digits are significant figures and the last digit specifies the number of zeros to follow = 01 and 02 schematics. For 05 schematic see footnote (*).

 $F = \pm 1\%$ $G = \pm 2\%$ $J = \pm 5\%$

EXAMPLE:

M8340103M6801GA = A flat pack resistor network with 14 pins, a T.C.R. of \pm 300PPM/°C, resistance value of 6.8k ohm, tolerance of 2% and to schematic "A".

EXAMPLE:

M8340103M6801GB = A flat pack resistor network with 14 pins, a T.C.R. of \pm 300PPM/°C, resistance value of 6.8k ohm, tolerance of 2% and to schematic "B".

EXAMPLE:

M8340103KA001GJ = A flat pack resistor network with 14 pins, a T.C.R. of \pm 100PPM/°C, R1 resistance value of 82 ohm, R2 resistance value of 130 ohm, tolerance of \pm 2% and schematic "J".

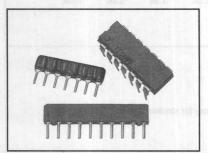
DFM14-01, 02, 05 = Type G (gold plated) DFM14-11, 12, 15 = Type G (hot-solder dipped) Hot-solder dipped leads supplied as standard finish, unless otherwise specified.

* The J-schematic resistance values are specified by a 4-digit code, which comes from MIL-R-83401. The codes and corresponding resistance values are:

CODE	R1 (Ohms)	R2 (Ohms)	CODE	R1 (Ohms)	R2 (Ohms)
A001	82	130	A010	330	470
A002	120	200	A011	330	680
A003	130	210	A012	1.5k	3.3k
A004	160	260	A013	3k	6.2k
A005	180	. 240	A014	180	270
A006	180	390	A015	270	270
A007	220	270	A016	560	560
A008	220	330	A017	560	1.2k
A009	330	390	A018	620	1.2k

CUSTOM NETWORKS DIPS, Molded SIPS, Coated SIPS

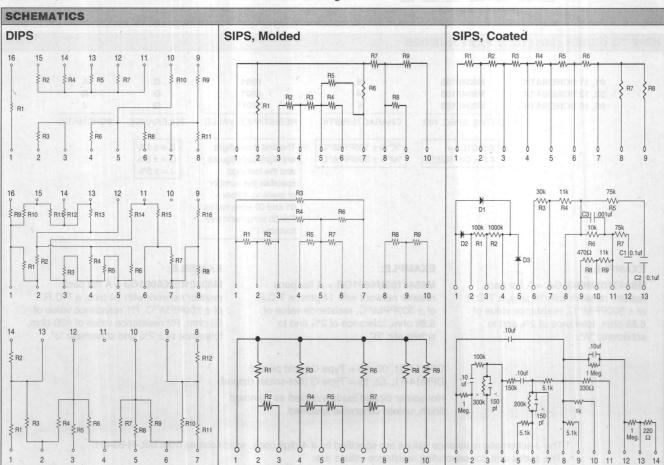




FEATURES

- · Fast turnaround time
- · Unlimited schematics possible
- · Design through production
- Processed to MIL-R-83401
- · High temperature solder joints
- · Made in the U.S.A.
- Wide resistance range

- · Ultra high precision laser trimming
- Double sided printing and through holes/VIAs
- · High density circuit designs
- Tighter parameters available
- · High power ratings available
- Custom resistor, capacitor, diode and inductor network combinations



ELECTRICAL SPECIFICATIONS

Resistance Range: 1 ohm to 20 Megohm.

Tolerance: \pm 0.5%. Tighter tolerances available.

Temperature Coefficient: \pm 50PPM/°C available.

T. C. R. Tracking: \pm 50PPM/°C available. Ratio Matching: \pm 0.5% available.

Power Per Resistor: 1/8 watt @ 70°C typical.

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film.

Solder Joints: High temperature SN10.

Encapsulation: Phthalate for molded.

Epoxy for conformal coated.

Lead Lengths: .060" [1.52] to .190" [4.83] molded,

.060" [1.52] to .290" [7.37] coated.

Substrates: 96% Alumina. Thicknesses: .020" [.508]

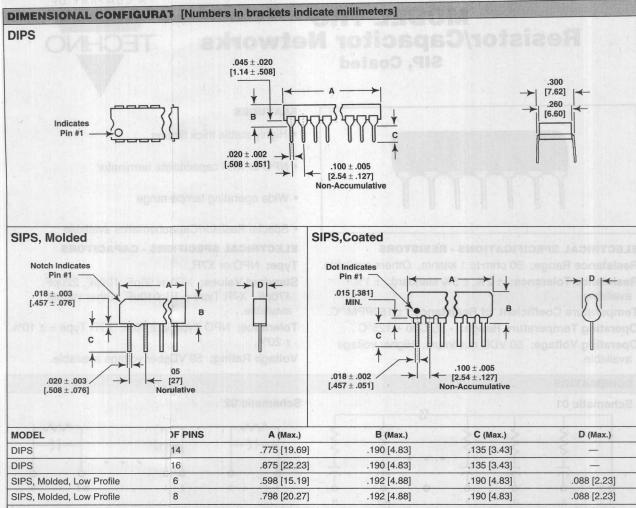
to .100" [2.54].

Resistor Coatings: Glass passivation, dielectrics for

crossovers.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 125°C.



DIPS	14	.775 [19.69]	.190 [4.83]	.135 [3.43]	5 -
DIPS	16	.875 [22.23]	.190 [4.83]	.135 [3.43]	
SIPS, Molded, Low Profile	6	.598 [15.19]	.192 [4.88]	.190 [4.83]	.088 [2.23]
SIPS, Molded, Low Profile	8	.798 [20.27]	.192 [4.88]	.190 [4.83]	.088 [2.23]
SIPS, Molded, Low Profile	10	.998 [25.35]	.192 [4.88]	.190 [4.83]	.088 [2.23]
SIPS, Molded, High Profile	6	.598 [15.19]	.340 [8.64]	.190 [4.83]	.088 [2.23]
SIPS, Molded, High Profile	8	.798 [20.27]	.340 [8.64]	.190 [4.83]	.088 [2.23]
SIPS, Molded, High Profile	10	.998 [25.35]	.340 [8.64]	.190 [4.83]	.088 [2.23]
SIPS, Coated	2	.200 [5.08]	.200 [5.08]	.290 [7.37]	.100 [2.54]
SIPS, Coated	nru 19	*	*	.290 [7.37]	*
SIPS, Coated	20	2.00 [50.80]	*	.290 [7.37]	*
* Depending on customer requirements	S	Parking the Asset of the Parking			

FOT 1	BANKEL HATEL TO BURNE	MAY AD (Tomical Tank Late)	
TEST 1		MAX. ∆R (Typical Test Lots)	
Power Conditioning	8)	ΔR < 0.10%	
Thermal Shock	7)		
Thermal Shock Group C	7)	ΔR < 0.10%	Maria de la companya
Short Time Overload		ΔR < 0.03%	
Low Temperature Storage		ΔR < 0.02%	
Low Temperature Operation		ΔR < 0.02%	THE REAL PROPERTY.
High Temperature Exposure		ΔR < 0.06%	
Moisture Resistance	6)	ΔR < 0.10%	
Resistance to Soldering Heat	0) 4-13-10-11-11-10-10-10-10-1	ΔR < 0.10%	
Shock	3)	ΔR < 0.04%	erosn e torcessivitem —
Vibration	4)	ΔR < 0.04%	- Abro etali -
Load Life	8)	ΔR < 0.22%	Maritimal a Facility

ELECTRICAL SPECIFICATIONS - RESISTORS

Resistance Range: 50 ohm to 1 kilohm. Others available. Resistance Tolerance: $\pm\,2\%$, $\pm\,5\%$ standard. $\pm\,1\%$ available.

Temperature Coefficient of Resistance: ± 150PPM/°C.

Operating Temperature Range: - 55°C to + 125°C.

Operating Voltage: 50 VDC maximum. Higher voltage available.

Special Resistor/Capacitematics available

ELECTRICAL SPECIFICAS - CAPACITORS

Type: NPO or X7R.

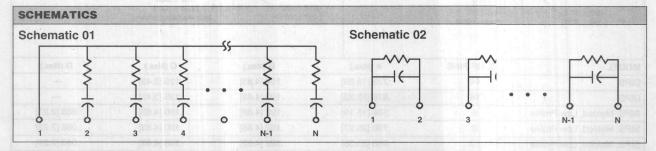
Standard Values: NPO T 56pF, 100pF, 220pF, 470pF. X7R Type = 100010uF. Other values

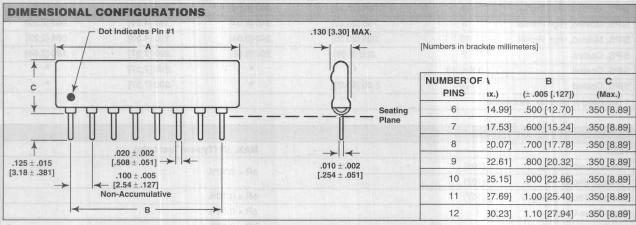
available.

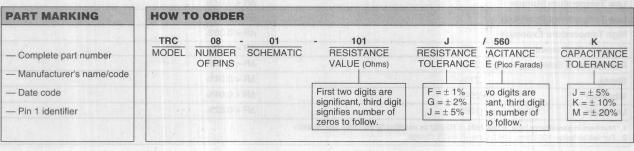
Tolerance: NPO Type = \pm 10%. X7R Type = \pm 10%,

± 20%.

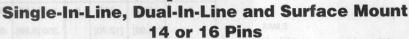
Voltage Rating: 50 VDC. er voltage available.



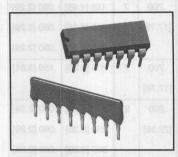




R/C NETWORKS Resistor/Capacitor Networks





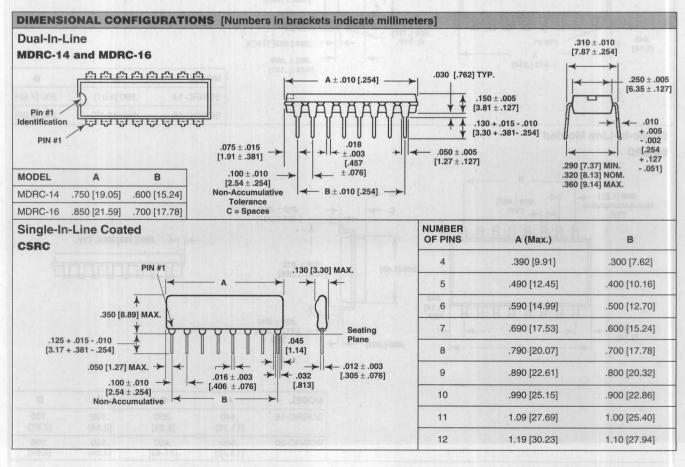


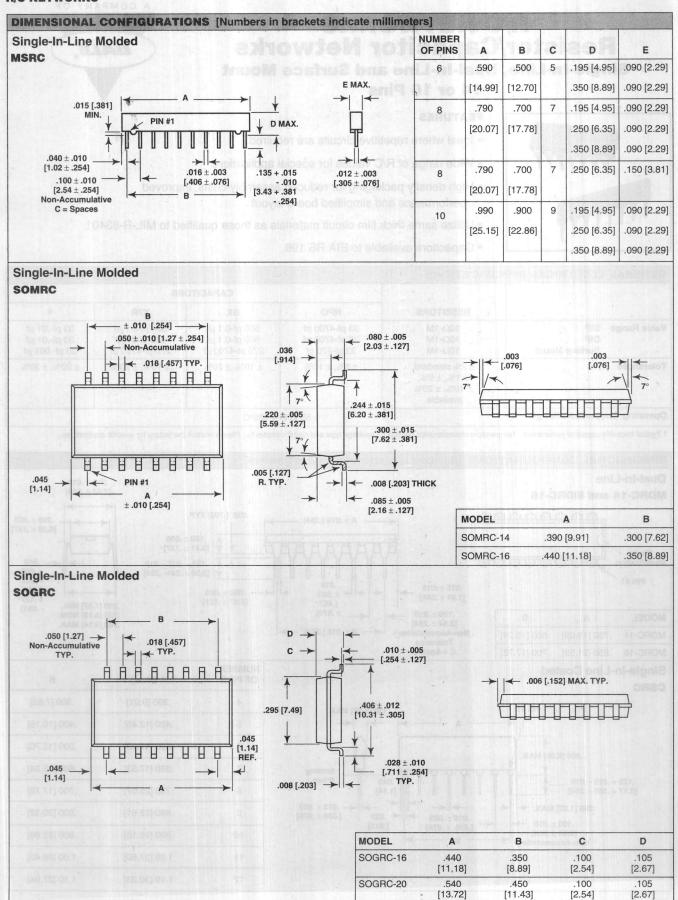
FEATURES

- · Ideal where repetitive circuits are required
- · Wide range of R/C values for special applications
- High density packaging for reduced assembly costs, improved performance and simplified board layout
- Utilize same thick film circuit materials as those qualified to MIL-R-83401
- Capacitors available to EIA RS 198

GENERAL ELECTRICA	L SPECIFICATIONS				
			CAPACITO	ORS	
	RESISTORS	NPO	вх	X7R	*
Value Range SIP DIP Surface Mour	10Ω-1M 10Ω-1M 10Ω-1M	33 pf-4700 pf 33 pf-4700 pf 33 pf-270 pf	500 pf-0.1 μf 500 pf-0.1 μf 270 pf-4700 μf	500 pf-0.1 μf 500 pf-0.1μf 270 pf-4700 μf	33 pf01 μf 33 pf01 μf 33 pf001 μf
Tolerances	± 2% standard. ± 1%, ± 5%, ± 10%, ± 20% available.	± 5%, ± 10%	± 10%, ± 20%	± 10%, ± 20%	± 20%, ± 30%

^{*} Typical thick-film capacitor parameters. Temperature characteristics depend on package type and circuit complexity. Please consult the factory for specific applications.





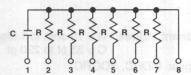
R/C NETWORKS

DESIGN CONSIDERATIONS

A wide variety of Capacitor and Resistor/Capacitor Network schematics can be provided for many applications. However, the exact capacitor and resistor parameters will depend on the specific application, the circuit complexity and the package style chosen. Please consult the factory for assistance with a design that optimizes your chosen circuit parameters.

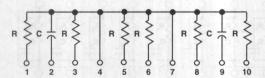
TYPICAL SCHEMATICS Schematic B Schematic A C, C C 10 Typical Component Values: R = 10 ohm to 1 Megohm Typical Component Values: R = 10 ohm to 1 Megohm C = 33 pf to 220 pfC = 33 pf to 220 pfTypical Packages: MDRC, SOGRC Typical Packages: MDRC, SOGRC Schematic C Schematic D Typical Component Values: R = 10 ohm to 1 Megohm Typical Component Values: R = 50 ohm, 100 ohm, 1k $C = 33 \text{ pf}, 220 \text{ pf}, .01 \mu\text{f}$ $C = 100 \text{ pf}, 470 \text{ pf}, .001 \mu\text{f}$ Typical Packages: MDRC, SOMRC, SOGRC Typical Packages: MDRC Schematic E Schematic F Typical Component Values: R = 100 ohm, 500 ohm Typical Component Values: R = 50 ohm, 100 ohm C = 100 pf, 1000 pf $C = 0.001 \mu f$, 0.01 μf Typical Packages: MDRC Typical Packages: CSRC, MSRC

CSRC-08B20 Schematic



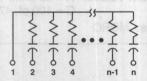
The CSRC-08B20 single-in-line 10k ECL terminator network is used for decoupling and line termination in systems using 10k ECL logic.

CSRC-10B21 Schematic



The CSRC-10B21 single-in-line 100k ECL terminator network is used for decoupling and line termination in systems using 100k ECL logic.

CSRC-XXC30 Schematic



The CSRC-XXC30 single-in-line terminator network is used for line termination and is available in 6, 7, 8, 9, 10, 11 and 12 pin sizes.

RESISTOR SPECIFICATIONS

Resistance Range:

CSRC-08B20, CSRC-10B21 = 50 ohm, 68 ohm,

100 ohm, 150 ohm.

CSRC-XXC30 = 50 ohm to 1 kilohm. (Other values available on request.)

Tolerance: ±5% standard. ±2% available.

Temperature Coefficient: (- 55°C to + 125°C)

± 150PPM/°C.

Operating Voltage:

CSRC-08B20, CSRC-10B21 = 8 VDC maximum.

CSRC-XXC30 = 50 VDC maximum.

CAPACITOR SPECIFICATIONS

Model: CSRC = 08B20, CSRC-10B21 = X7R. CSRC-XXC30 = NPO or X7R.

Standard Values:

CSRC-08B20, CSRC-10B21 = $.01 \, \mu f$.

CSRC-XXC30: NPO type = 56 pf, 100 pf, 220 pf, 470 pf.

X7R type = 1000 pf, .01 µf. (Other values available on request.)

Tolerance:

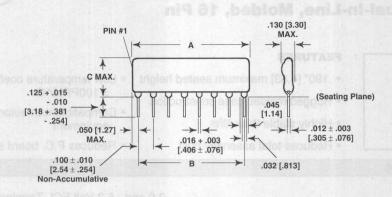
CSRC-08B20, CSRC-10B21 = 20% standard.

CSRC-XXC30, NPO type = \pm 10%, X7R type = \pm 20%.

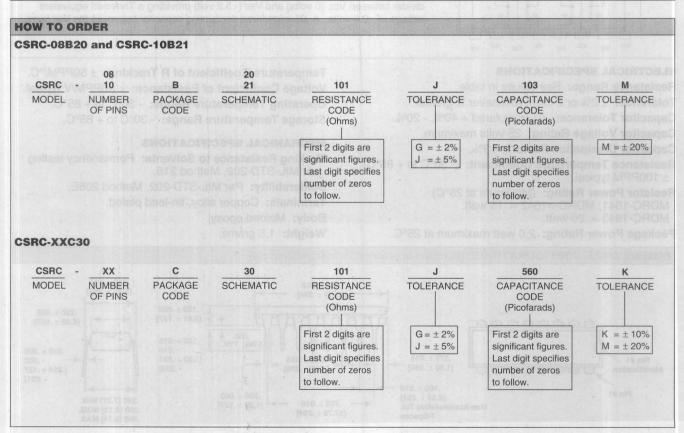
Voltage Rating: CSRC-08B20, CSRC-10B21 = 25 VDC.

CSRC-XXC30 = 50 VDC.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



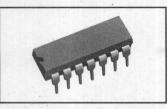
Model CSR	C-08B20			Model CSRC-XXC30				
NUMBER OF PINS	A (Max.)	te to sur Binar Ca	entatoro C	NUMBER OF PINS	A (Max.)	B	C C	
8	.790	.700	.250	6 (415)	.590 [14.99]	.500 [12.70]	.350 [8.89]	
[20.07] [17.78]				7	.690 [17.53]	.600 [15.24]	.350 [8.89]	
Model CSR	C-10B21	asud egshov sn	HO emstericit	8	.790 [20.07]	.700 [17.78]	.350 [8.89]	
NUMBER				9	.890 [22.61]	.800 [20.32]	.350 [8.89]	
OF PINS	A (Max.)	В	C	10	.990 [25.15]	.900 [22.86]	.350 [8.89]	
10 .990		.900	.250	11	1.09 [27.69]	1.00 [25.40]	.350 [8.89]	
	[25.15]	[22.86]	[6.35]	12	1.19 [30.23]	1.10 [27.94]	.350 [8.89]	



MODEL MDRC Resistor/Capacitor Networks

Dual-In-Line, Molded, 16 Pin



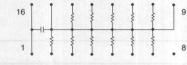


FEATURES

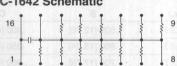
- .190" [4.83] maximum seated height
- · Rugged molded case construction
- · Highly stable thick film
- · Reduces total assembly cost
- Low temperature coefficient (-30°C to + 85°C) + 100PPM/°C
- Compatible with automatic insertion equipment
- · Reduces P.C. board space

CIRCUIT APPLICATIONS

MDRC-1641 Schematic



MDRC-1642 Schematic

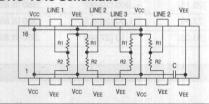


- 2.0 and - 5.2 Volt ECL Terminator

The MDRC-1641 circuit contains 11 resistors of nominally equal value and a .01 microfarad decoupling capacitor. The MDRC-1641 is designed for ECL Line Termination to a - 2.0 volt buss. The .01 microfarad decoupling capacitor is for bypassing transients between supply voltages.

The MDRC-1642 circuit contains 12 resistors of 510 ohm each and a .01 microfarad decoupling capacitor. The MDRC-1642 is designed for ECL Pull-down to a - 5.2 volt buss. The .01 microfarad decoupling capacitor is for bypassing voltage transients on the voltage buss.

MDRC-1643 Schematic



Thevenin Equivalent Terminator

The MDRC-1643 contains four pairs of series resistors. The circuit is compatible with ECL pin configurations. Each terminator section (series pair) contains a voltage divider between Vcc (0 volts) and VEE (- 5.2 volt) providing a Thevenin equivalent voltage of - 2.0 volts. A .01 microfarad decoupling capacitor bypasses the VEE buss.

ELECTRICAL SPECIFICATIONS

Resistance Range: See values in table.

Tolerance: \pm 2% or 2 ohm, whichever is greater. **Capacitor Tolerance:** .01 microfarad + 40%, - 20%.

Capacitor Voltage Rating: 25 volts maximum.

Capacitor Dissipation Factor: < 3%.

Resistance Temperature Coefficient: (- 30°C to + 85°C)

± 100PPM typical.

Resistor Power Rating: (Maximum at 25°C) MDRC-1641, MDRC-=1642 = .15 watt.

MDRC-1643 = .20 watt.

Package Power Rating: 2.0 watt maximum at 25°C.

Temperature Coefficient of R Tracking: ± 50 PPM/°C. Voltage Coefficient of Resistance: < 50PPM/V typical. Operating Temperature Range: -30°C to +85°C. Storage Temperature Range: -30°C to +85°C.

MECHANICAL SPECIFICATIONS

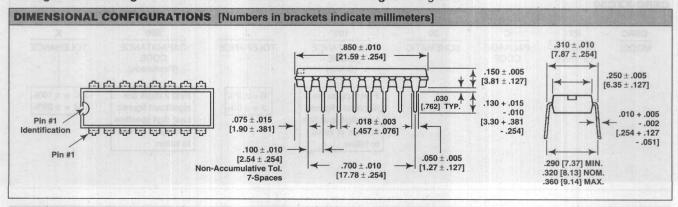
Marking Resistance to Solvents: Permanency testing

per MIL-STD-202, Method 215.

Solderability: Per MIL-STD-202, Method 208E.

Terminals: Copper alloy, tin-lead plated.

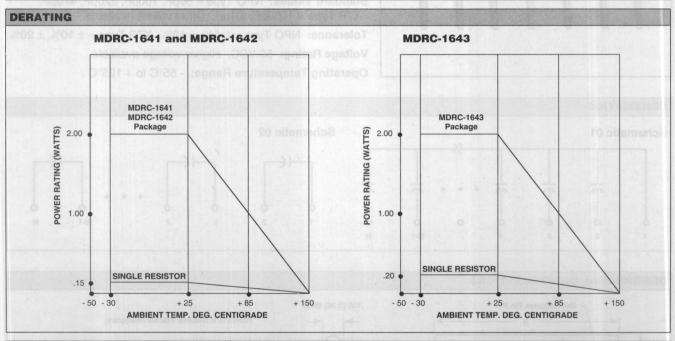
Body: Molded epoxy. Weight: 1.5 grams.



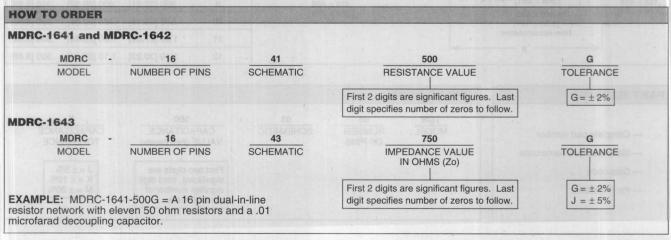
184

MODEL MDRC

ENVIRONMENTAL PERFOR	ENVIRONMENTAL PERFORMANCE *							
TEST	CONDITIONS	MAX. △R (Typical Test Lots)						
Thermal Shock	MDRC-1641 and MDRC-1642, 5 cycles between - 30°C and + 85°C MDRC-1643, 5 cycles between - 65°C and + 125°C	± 0.50% ΔR						
Short Time Overload	2 1/2 x rated working voltage 5 seconds	± 0.25% ΔR						
Low Temperature Operation	MDRC-1641 and MDRC-1642, 45 minutes at full rated working voltage at - 30°C MDRC-1643, 45 minutes at full rated working voltage at - 65°C	± 0.25% ΔR						
Moisture Resistance	240 hours with humidity ranging from 80% RH to 98% RH	± 0.50% ΔR						
Resistance to Soldering Heat	Leads immersed in 350°C solder to within 1/16" of device body for 3 seconds	± 0.25% ΔR						
Shock	Total of 18 shocks at 100 G's	± 0.25% ΔR						
Vibration	12 hours at maximum of 20 G's between 10 and 2,000 Hz	± 0.25% ΔR						
Load Life	1,000 hours at 70°C, rated power applied 1 1/2 hours on, 1/2 hour off for full 1,000 hour period. Derated according to the curve.	± 0.50% ΔR						
Terminal Strength	4 1/2 pound pull for 30 seconds	± 0.25% ΔR						
Insulation Resistance	10,000 Megohm (minimum)							
Dielectric Withstanding Voltage	(200 V RMS for 1 minute)							
* Test methods per MIL-STD-202.								



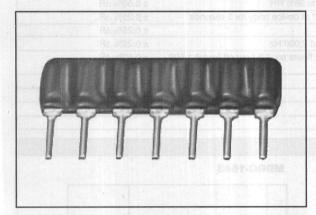
RESISTANCE VALUES IN OHMS	("G" Tolerance)			
MDRC-1641	MDRC-1642		MDRC-1643	
50	510	Rı	R ₂	Zo
68	Panne	81	130	50
75 188 71 088		121	195	75
100 100 000		162	260	100



MODEL TCN Capacitor Networks

SIP, Coated





FEATURES

- NPO or X7R capacitors for line terminator
- · Wide operating temperature range
- · Special Capacitor schematics available

ELECTRICAL SPECIFICATIONS

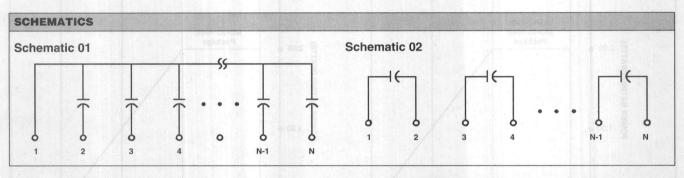
Type: NPO or X7R.

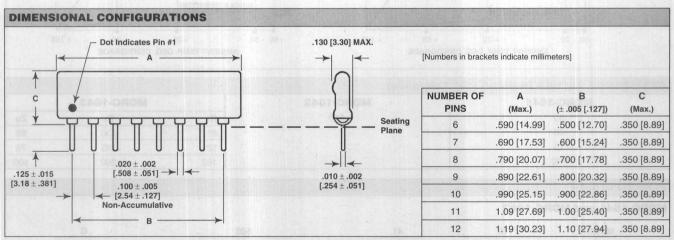
Standard Values: NPO Type = 56pF, 100pF, 220pF, 470pF. X7R Type = 1000pF, .01uF. Other values available.

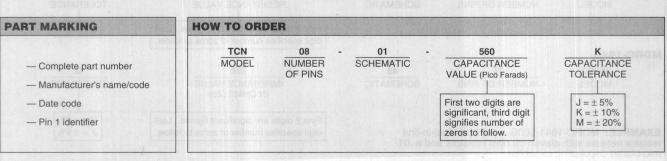
Tolerance: NPO Type = $\pm 5\%$, $\pm 10\%$. X7R Type = $\pm 10\%$, $\pm 20\%$.

Voltage Rating: 50 VDC. Higher voltage available.

Operating Temperature Range: -55°C to + 125°C.



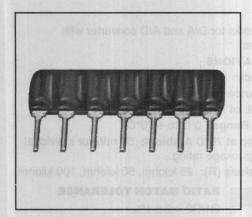




MODEL TxxS, R/2R Ladder Networks

SIP, Coated, 4 Bits to 8 Bits





APPLICATIONS

R/2R Ladder networks for D/A and A/D converter with bi-polar or CMOS switches

ELECTRICAL SPECIFICATIONS

Ladder Network Accuracy on Linearity: ± 1/2 LSB.

Ladder Network Resistance Tolerance: ±2%.

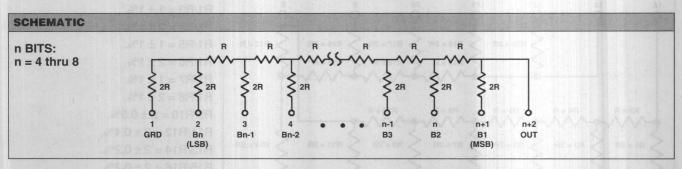
Temperature Coefficient of Resistance: ± 100PPM/°C.

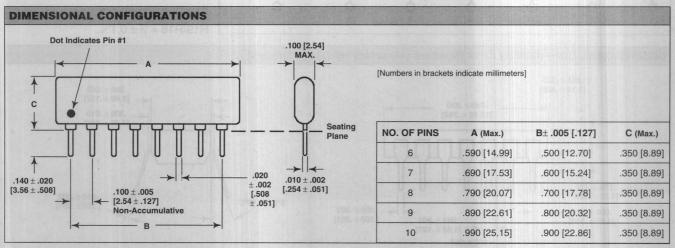
Operating Temperature Range: - 55°C to + 125°C.

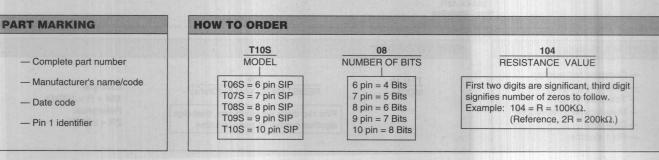
Power Dissipation Rating at 70°C Ambient: 50 mW/element.

Standard Resistance Values (R): 5 kilohms, 10 kilohms, 25 kilohms,

50 kilohms and 100 kilohms.



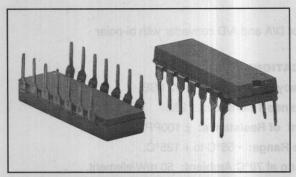




MODEL T14L10 **R/2R Ladder Networks**

DIP, 10 Bit





APPLICATIONS

10 Bit. R/2R Ladder networks for D/A and A/D converter with bi-polar or CMOS switches

ELECTRICAL SPECIFICATIONS

Ladder Network Accuracy: ± 1 LSB from 0°C to + 70°C.

Ladder Network Resistance Tolerance: ±2%.

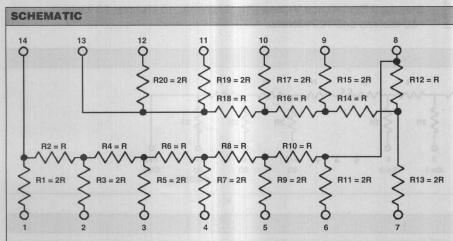
Temperature Coefficient of Resistance: ± 100PPM/°C.

Operating Temperature Range: 0°C to + 70°C.

Power Dissipation Rating at 70°C Ambient: 50 mW for individual

resistor and 1.6 W total package rating.

Standard Resistance Values (R): 25 kilohm, 50 kilohm, 100 kilohm.



RATIO MATCH TOLERANCE

 $R1/R2 = 2 \pm 1\%$.

 $R1/R3 = 1 \pm 1\%$.

 $R1/R4 = 2 \pm 1\%$.

 $R1/R5 = 1 \pm 1\%$.

 $R1/R6 = 2 \pm 1\%$.

 $R1/R7 = 1 \pm 1\%$.

 $R1/R8 = 2 \pm 1\%$.

 $R9/R10 = 2 \pm 0.5\%$.

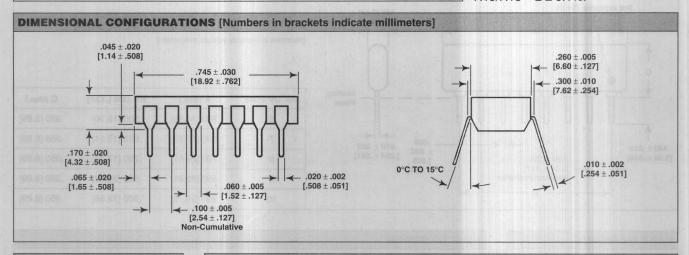
 $R11/R12 = 2 \pm 0.4\%$.

 $R13/R14 = 2 \pm 0.2\%$.

 $R15/R16 = 2 \pm 0.2\%$.

 $R19/R17 = 1 \pm 0.1\%$.

 $R19/R18 = 2 \pm 0.1\%$.



PART MARKING

- Complete part number
- Resistance Value
- Tolerance Value
- Manufacturer's name/code
- Date code
- Pin 1 identifier

HOW TO ORDER

T14L10 MODEL

RESISTANCE VALUE (Ohms)

First two digits are significant, third digit signifies number of zeros to follow.

Example: 104 = R = 100kΩ.

Reference: $2R = 200k\Omega$.

17

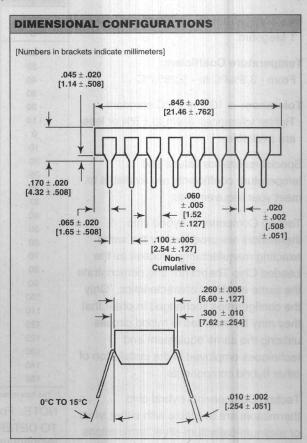
resistor and 1.8 W total package rating.

Standard Resistance Values (R): 25 kilohms, 50 kilohms and 100 kilohms.

RATIO MATCH TOLERANCE

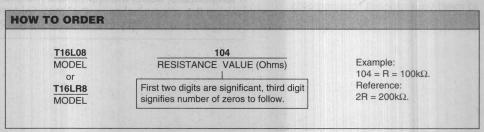
$R1/R2 = 2 \pm 1\%$.	$R1/R6 = 2 \pm 1\%$.	$R11/R12 = 2 \pm 0.4\%$.
$R1/R3 = 1 \pm 1\%$.	$R1/R7 = 1 \pm 1\%$.	$R15/R13 = 1 \pm 0.2\%$.
$R1/R4 = 2 \pm 1\%$.	$R1/R8 = 2 \pm 1\%$.	$R15/R14 = 2 \pm 0.2\%$.
$R1/R5 = 1 \pm 1\%$.	$R9/R10 = 2 \pm 0.5\%$.	

SCH	EMATIC	S					
T16L	.08						
16	15 O	14 O	13 O	12 O	11 O	10 O	9 R16 = 2R
5~	NEN	= R R6	NEN	~ {~	~~	2 = R R14	√ }
8	2R > R3	= 2R S R5	= 2R \(\) R7 = 4	= 2R > R9 :	6 PR11	= 2R\ R13	= 2R R15 = 2F 8
T161	LR8	76990		06822 04832		311	47190. - 88780.
16	15 O	14	13 O	12 O	11 0	10	9 Q R16 = 2F
\$~	NÃN	NEV	~ * ~	= R R10	NAN	2 = R R14	=R
>R1 =	2R S R3	= 2R S R5	= 2R S R7 :	= 2R S R9	= 2R SR11	= 2R R13 :	= 2R R15 = 2F



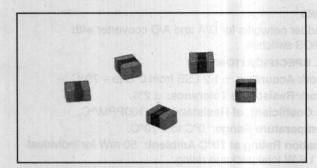
PART MARKING

- Complete part number
- Resistance Value
- Tolerance Value
- Manufacturer's name/code
- Date code
- Pin 1 identifier



MODELS 7 and 8 NTC Thermistors Hybrid Chip





FEATURES

- Model 7 Wraparound terminations
- . Model 8 Top and bottom terminations
- Flow solderable
- · Can be mounted with conductive epoxy
- · Automatic placement capability
- 8mm tape and reel available
- · High density construction ensures long life and reliability

ELECTRICAL SPECIFICATIONS

Resistance Range: 5000 ohm to 1 Megohm.

Temperature Coefficient:

From - 3.9%/°C to - 5.26%/°C.

Tolerance: \pm 10% at 25°C standard. Tighter tolerances down to \pm 5% or less are available.

Special resistance values and temperature coefficients are available to meet your requirements.

Techno Components hybrid chip thermistors are produced by the same exacting manufacturing process as the Leaded Chip Thermistor and demonstrate the same electrical characteristics. Only the configuration is changed in order that they may be mounted in hybrid circuits utilizing the same equipment and techniques employed in the installation of other hybrid components.

Techno Components hybrid chip thermistors are available with either silver or platinum-palladium-silver terminations to meet your process requirements.

TEMP.		MATE	RIAL/BETA 25°C	/75°C	
°C	J/3964*	D/3477*	M/4437*	U/3925*	X/4842*
- 55	96.77	53.4	126.1		176.4
- 50	67.23	38.99	86.92	56.49	119.0
- 40	33.72	21.45	42.69	29.49	98.0
- 30	17.72	12.27	21.84	16.03	27.45
- 20	9.713	7.278	11.66	9.04	18.981
- 10	5.534	4.459	6.385	5.267	7.2731
0	3.266	2.815	3.621	3.166	4.018
10	1.990	1.826	2.123	1.958	2.236
20	1.249	1.215	1.277	1.243	1.3031
25	1.0	1.0	1.0	1.0	1.0
30	.8056	.8276	.7880	.8090	.7723
37	.6015	.6406	.5702	.6070	.5434
40	.5326	.5758	.4981	.5383	.4690
50	.3602	.4086	.3219	.3657	.2914
60	.2489	.2954	.2124	.2533	.1849
70	.1753	.2172	.1429	.1786	.1198
80	.1258	.1622	.09790	.1281	.07902
90	.09174	.1229	.06823	.09330	.05307
100	.06798	.09446	.04832	.06897	.03624
110	.05110	.07350	.03474	.05167	.02514
120	.03894	.05788	.02533	.03920	.01770
125	.03416	.05158	.02174	.03430	.01493
130	.03005	.04609	.01872	.03010	.01264
140	.02347	.03708	.01401	.02337	.00915
150	.01853	.03012	.01061	.01834	.00670

^{*} The type material is defined in the part number by the letter following the first digit in the number.

NOTE: For 1°C Ratio Tables - contact factory.

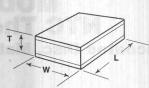
TO DETERMINE THE RESISTANCE of a thermistor at a specified temperature, select the appropriate material letter from the part number and using the column below for that material type, find the RMF at the desired temperature. Multiply that factor times the 25°C resistance of the thermistor.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

MODEL 7







[Numbers in brackets indicate millimeters]

1,000,000	MODEL	T.C. %/°C	T ± .010 [.254]	± .010 [.254]	± .010 [.254]
1,000,000	7M105-J	- 4.79	.014 [.356]	.054 [1.37]	.102 [2.59]
500,000	7U504-J	- 4.30	.029 [.734]	.053 [1.35]	.102 [2.59]
100,000	7J104-J	- 4.40	.016 [.406]	.033 [1.03]	.107 [2.72]
80,000	7J803-J	- 4.40			THE RESERVE OF THE PROPERTY OF
	CHILD DESCRIPTION OF THE PROPERTY OF THE PROPE	U SCHOOL CLOSE DESCRIPTION OF THE SECOND	.015 [.381]	.053 [1.35]	.102 [2.59]
60,000	7J603-J	- 4.40	.019 [.483]	.053 [1.35]	.102 [2.59]
50,000	7J503-J	- 4.40	.024 [.610]	.051 [1.30]	.102 [2.59]
40,000	7J403-J	- 4.40	.028 [.711]	.053 [1.35]	.102 [2.59]
30,000	7J303-J	- 4.40	.032 [.813]	.060 [1.52]	.102 [2.59]
15,000	7D153-J	- 3.83	.016 [.406]	.043 [1.09]	.102 [2.59]
10,000	7D103-J	- 3.83	.020 [.508]	.051 [1.30]	.102 [2.59]
8,000	7D802-J	- 3.83	.024 [.610]	.052 [1.32]	.102 [2.59]
7,000	7D702-J	- 3.83	.025 [.635]	.056 [1.42]	.102 [2.59]
6,000	7D602-J	- 3.83	.029 [.737]	.056 [1.42]	.102 [2.59]
5,000	7D502-J	- 3.83	.033 [.838]	.058 [1.47]	.102 [2.59]
5,000	7D502-1206-J	- 3.83	.042 [1.07]	.063 [1.60]	.126 [3.20]
6,000	7D602-1206-J	- 3.83	.035 [.889]	.063 [1.60]	.126 [3.20]
7,000	7D702-1206-J	- 3.83	.030 [.762]	.063 [1.60]	.126 [3.20]
8,000	7D802-1206-J	- 3.83	.027 [.686]	.063 [1.60]	.126 [3.20]
10,000	7D103-1206-J	- 3.83	.022 [.559]	.063 [1.60]	.126 [3.20]
4,000	7D402-1208-J	- 3.83	.041 [1.04]	.079 [2.01]	.126 [3.20]
3,000	7D302-1210-J	- 3.83	.044 [1.12]	.098 [2.49]	.126 [3.20]
10,000	7J103-1012-N	- 4.40	.065 [1.65]	.126 [3.20]	.098 [2.49]
100,000	7J104-1205-N	- 4.40	.026 [.660]	.049 [1.24]	.126 [3.20]
50,000	7J503-1206-N	- 4.40	.039 [.991]	.063 [1.60]	.126 [3.20]
10,000	7D103-1206-N	- 3.83	.033 [.838]	.063 [1.60]	.126 [3.20]
1,000,000	8X105-H	- 5.20	.020 [.508]	.043 [1.09]	.043 [1.09]
500,000	8X504-H	- 5.20	.016 [.406]	.053 [1.35]	.053 [1.35]
250,000	8X254-H	- 5.20	.016 [.406]	.075 [1.91]	.075 [1.91]
200,000	8M204-H	- 4.79	.035 [.889]	.041 [1.04]	.041 [1.04]
100,000	8X104-H	- 5.20	.016 [.406]	.120 [3.05]	.120 [3.05]
100,000	8U104-H	- 4.30	.024 [.610]	.049 [1.24]	.049 [1.24]
100,000	8M104-H	- 4.79	.032 [.813]	.054 [1.37]	.054 [1.37]
80,000	8U803-H	- 4.30	.020 [.508]	.049 [1.24]	.049 [1.24]
50,000	8U503-H	- 4.30	.015 [.381]	.053 [1.35]	.053 [1.35]
50,000	8M503-H	- 4.79	.015 [.381]	.051 [1.30]	.051 [1.30]
30,000	8U303-H	- 4.30	.013 [.330]	.054 [1.37]	.072 [1.83]
30,000	8M303-H	- 4.79	.013 [.330]	.066 [1.68]	.066 [1.68]
30,000	8J303-H	- 4.40	.032 [.813]	.029 [.737]	.029 [.737]
20,000	8J203-H	- 4.40	.032 [.813]	.036 [.914]	.036 [.914]
15,000	8J153-H	- 4.40	.032 [.813]	.042 [1.07]	.042 [1.07]
10,000	8J103-H	- 4.40	.032 [.813]	.051 [1.30]	.051 [1.30]
3,000	8J302-H	- 4.40	.032 [.813]	.054 [1.37]	.068 [1.73]
2,000	8J202-H	- 4.40	.015 [.381]	.054 [1.37]	.101 [2.57]
2,000	8D202-H	- 3.83	.015 [.361]	.049 [1.24]	TO SECURITY A SHIPLE TO SECURE A SHIPLE OF THE SECURITY AND ADDRESS OF THE SECURITY ADDRESS OF THE
1,000	8D102-H	- 3.83	.037 [.940]		.049 [1.24]
1,000	8J102-H	- 3.83		.053 [1.35]	.053 [1.35]
500			.015 [.381]	.105 [2.67]	.105 [2.67]
	8D501-H	- 3.83	.015 [.381]	.060 [1.52]	.060 [1.52]
500	8J501-H	- 4.40	.015 [.381]	.148 [3.76]	.148 [3.76]
300 50	8D301-H 8D50R0-H	- 3.83 - 3.83	.015 [.381]	.077 [1.96]	.077 [1.96]

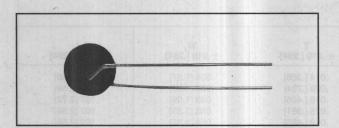
NOTE: Models with J Conductor also available in H and G Conductor. Gold terminations available as specials. Consult factory.

7	D	103	7008.	-5
MODEL	MATERIAL	VAĻUE	CONDUCȚOR TYPE	TOLERANCE
7 = Wraparound	D = TC - 3.83%	First 2 digits are	H = Silver	± 10% = None
8 = Top and Bottom	J = TC - 4.4%	significant. The last	G = Palladium Silver	± 5% = - 5
	M = TC - 4.79%	digit is number of	J = Platinum Palladium Silver	
	U = TC - 4.3%	zeros in value.	N = Nickel Barrier	
	X = TC - 5.2%	Example: 10k = 103		

MODEL 1B NTC Thermistors

Uncoated Disc, Material 'B', 2.5 Ω to 500 Ω





APPLICATIONS

Engineered for

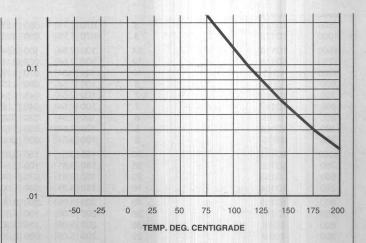
- Temperature compensation
- Temperature measurement
- Temperature control
- Meter compensation
- Voltage regulation
- Amplitude control
- Liquid level indication
- Flow measurement
- Surge suppression
- Time delay

12.00	NO ELEC	I HICAL SPEC		5 and DIM	ENSIONAL	CORFI	GURATIONS
R @ 25°C ± 10% (Ohms)	PART NUMBER	DISSIPATION * CONSTANT	THERMAL** TIME CONSTANT	A	В	LEADS AWG#	[Numbers in brackets indicate millimeters]
500	1B07	2	3	.050 [1.27]	.080 [2.03]	30	A (
400	1B08	2	3	.050 [1.27]	.070 [1.78]	30	Tinned Copper Wire
300	1B09	2	3	.050 [1.27]	.050 [1.27]	30	- Tinned Copper wire
250	1B095	2	2	.050 [1.27]	.040 [1.02]	30	
200	1B10	2	2	.050 [1.27]	.030 [.762]	30	[38.10]
150	1B11	2	2	.050 [1.27]	.025 [.635]	30	[38.10]
100	1B12	2	2	.050 [1.27]	.020 [.508]	30	B B
300	1B120	2.5	5	.070 [1.78]	.100 [2.54]	30	
250	1B125	2	4.5	.070 [1.78]	.085 [2.16]	30	
200	1B110	2	4	.070 [1.78]	.070 [1.78]	30	Composition "1D" thermisters are a part of a
150	1B111	2	3	.070 [1.78]	.050 [1.27]	30	Composition "1B" thermistors are a part of a
100	1B112	2	3	.070 [1.78]	.030 [.762]	30	family of thermal sensors representing a new
150	1B113	4	14	.100 [2.54]	.100 [2.54]	28	breakthrough in materials engineering.
125	1B115	4	12	.100 [2.54]	.085 [2.16]	28	After more than a decade of engineering
100	1B13	3	10	.100 [2.54]	.070 [1.78]	28	development and constant product
80	1B14	3	8	.100 [2.54]	.050 [1.27]	28	improvement, Techno Components has
70	1B145	3	7	.100 [2.54]	.045 [1.14]	28	formulated a thermal sensing material
60	1B147	3	7	.100 [2.54]	.040 [1.02]	28	called THERMOCERAM. The "1B"
50	1B15	3	6	.100 [2.54]	.030 [.762]	28	
40	1B165	3	5	.100 [2.54]	.030 [.762]	28	composition offers a broad range of
30	1B16	3	5	.100 [2.54]	.020 [.508]	28	resistance values. The design engineer can
100	1B151	7	30	.150 [3.81]	.150 [3.81]	24	specify from 2.5 ohms to 500 ohms from the
75	1B152	7	25	.150 [3.81]	.100 [2.54]	24	same basic type of thermistor. In addition to
50	1B153	7	20	.150 [3.81]	.075 [1.91]	24	this wide range of values, the Model "1B" is
25	1B154	7	18	.150 [3.81]	.040 [1.02]	24	an excellent, highly stable, broad application
80	1B118	8	40	.200 [5.08]	.200 [5.08]	24	thermal sensor that finds use in innumerable
75	1B117	8	36	.200 [5.08]	.190 [4.83]	24	
50	1B18	7	30	.200 [5.08]	.130 [3.30]	24	heat sensing designs.
30	1B19	7	25	.200 [5.08]	.080 [2.03]	24	Allthough not Military Qualified, all Model "1B"
20	1B20	7	20	.200 [5.08]	.050 [1.27]	24	thermistors conform to AQL and confidence
15	1B205	7	19	.200 [5.08]	.040 [1.02]	24	levels as specified in MIL-T-23648 as
10	1B21	7	18	.200 [5.08]	.030 [.762]	24	
30	1B22	9	75	.300 [7.62]	.180 [4.57]	24	outlined by tables V and VI.
20	1B225	8.5	60	.300 [7.62]	.120 [3.05]	24	Coatings, encapsulations markings, probes
10	1B23	8	48	.300 [7.62]	.050 [1.27]	24	and resistor/ thermistor networksare also
7.5	1B235	8	42	.300 [7.62]	.045 [1.14]	24	available to meet specific requirements by
5	1B24	8	35	.300 [7.62]	.030 [.762]	24	contacting our application engineering
15	1B119	10	85	.400 [10.16]	.160 [4.06]	22	department.
12.5	1B265	10	77	.400 [10.16]	.130 [3.30]	22	
10	1B26	9	70	.400 [10.16]	.100 [2.54]	22	Resistance tolerances of \pm 1% thru \pm 20%
7.5	1B27	9	65	.400 [10.16]	.080 [2.03]	22	are available and may be specified at 25°C
5	1B28	9	50	.400 [10.16]	.050 [1.27]	22	or any temperature within the operating
2.5	1B33	14	60	.500 [12.70]	.040 [1.02]	22	range.

^{*} Dissipation Constant, expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

^{**} Thermal Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

-33								
-33 10.3 20 1.18 73 .248 125 .0771 -32 9.79 21 1.14 74 .242 126 .0756 -31 9.32 22 1.11 75 .236 127 .0741 -30 8.93 23 1.07 76 .229 128 .0728 -29 8.51 24 1.03 77 .224 129 .0713 -28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193	-00	11.5	10	1.2/	/1	.261	123	.0801
-32 9.79 21 1.14 74 .242 126 .0756 -31 9.32 22 1.11 75 .236 127 .0741 -30 8.93 23 1.07 76 .229 128 .0728 -29 8.51 24 1.03 77 .224 129 .0713 -28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188	-34	10.8	19	1.22	72	.254	124	.0787
-31 9.32 22 1.11 75 .236 127 .0741 -30 8.93 23 1.07 76 .229 128 .0728 -29 8.51 24 1.03 77 .224 129 .0713 -28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 .85 .183	-33	10.3	20	1.18	73	.248	125	.0771
-30 8.93 23 1.07 76 .229 128 .0728 -29 8.51 24 1.03 77 .224 129 .0713 -28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 .85 .183 .137 .0612 -21.5 6.09 34 .756 87 .175	-32	9.79	21	1.14	74	.242	126	.0756
-29 8.51 24 1.03 77 .224 129 .0713 -28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 .133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171	-31	9.32	22	1.11	75	.236	127	.0741
-28 8.12 25 1.00 78 .218 130 .0700 -27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171	-30	8.93	23	1.07	76	.229	128	.0728
-27 7.78 26 .970 79 .213 131 .0686 -26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167	-29	8.51	24	1.03	77	.224	129	.0713
-26 7.41 27 .939 80 .208 132 .0673 -25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 .85 .183 .137 .0612 -21 5.93 .33 .779 .86 .179 138 .0601 -20 5.69 .34 .756 .87 .175 139 .0590 -19 5.43 .35 .732 .88 .171 .140 .0579 -18 5.20 .36 .710 .89 .167 .141 .0569 -17 4.98 .37 .689 .90 .1	-28	8.12	25	1.00	78	.218	130	.0700
-25 7.10 28 .910 81 .203 133 .0660 -24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 .85 .183 137 .0612 -21 5.93 33 .779 .86 .179 138 .0601 -20 5.69 34 .756 .87 .175 139 .0590 -19 5.43 .35 .732 .88 .171 .140 .0579 -18 5.20 .36 .710 .89 .167 .141 .0569 -17 4.98 .37 .689 .90 .163 .142 .0559 -16 4.75 37.8 .671 .91 .	-27	7.78	26	.970	79	.213	131	.0686
-24 6.80 29 .881 82 .198 134 .0648 -23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 .140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 .142 .0559 -16 4.75 37.8 .671 91 .159 .143 .0548 -15 4.56 38 .668 92 .156	-26	7.41	27	.939	80	.208	132	.0673
-23 6.49 30 .854 83 .193 135 .0636 -22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 .142 .0559 -16 4.75 37.8 .671 91 .159 .143 .0548 -15 4.56 38 .668 92 .156 .144 .0539 -14 4.37 39 .647 93 .152	-25	7.10	28	.910	81	.203	133	.0660
-22 6.21 31 .828 84 .188 136 .0624 -21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 .142 .0559 -16 4.75 37.8 .671 91 .159 .143 .0548 -15 4.56 38 .668 92 .156 .144 .0539 -14 4.37 39 .647 93 .152 .145 .0529 -13 4.18 40 .628 94 .148	-24	6.80	29	.881	82	.198	134	.0648
-21.5 6.09 32 .802 85 .183 137 .0612 -21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 .94 .148 146 .0520 -12 4.01 41 .608 .95 .145	-23	6.49	30	.854	83	.193	135	.0636
-21 5.93 33 .779 86 .179 138 .0601 -20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 .94 .148 146 .0520 -12 4.01 41 .608 .95 .145 147 .0511 -11 3.84 42 .589 96 .142	-22	6.21	31	.828	84	.188	136	.0624
-20 5.69 34 .756 87 .175 139 .0590 -19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139	-21.5	6.09	32	.802	85	.183	137	.0612
-19 5.43 35 .732 88 .171 140 .0579 -18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136	-21	5.93	33	.779	86	.179	138	.0601
-18 5.20 36 .710 89 .167 141 .0569 -17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 -94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-20	5.69	34	.756	87	.175	139	.0590
-17 4.98 37 .689 90 .163 142 .0559 -16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 .148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-19	5.43	35	.732	88	.171	140	.0579
-16 4.75 37.8 .671 91 .159 143 .0548 -15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 .95 .145 .147 .0511 -11 3.84 42 .589 .96 .142 .148 .0501 -10 3.68 43 .571 .97 .139 .149 .0492 -9 3.52 44 .554 .98 .136 .150 .0483	-18	5.20	36	.710	89	.167	141	.0569
-15 4.56 38 .668 92 .156 144 .0539 -14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-17	4.98	37	.689	90	.163	142	.0559
-14 4.37 39 .647 93 .152 145 .0529 -13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-16	4.75	37.8	.671	91	.159	143	.0548
-13 4.18 40 .628 94 .148 146 .0520 -12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-15	4.56	38	.668	92	.156	144	.0539
-12 4.01 41 .608 95 .145 147 .0511 -11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-14	4.37	39	.647	93	.152	145	.0529
-11 3.84 42 .589 96 .142 148 .0501 -10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-13	4.18	40	.628	- 94	.148	146	.0520
-10 3.68 43 .571 97 .139 149 .0492 -9 3.52 44 .554 98 .136 150 .0483	-12	4.01	41	.608	95	.145	147	.0511
-9 3.52 44 .554 98 .136 150 .0483	-11	3.84	42	.589	96	.142	148	.0501
	-10	3.68	43	.571	97	.139	149	.0492
-8 3.39 45 .537	-9	3.52	44	.554	98	.136	150	.0483
	-8	3.39	45	.537				



To determine the resistance of a thermistor at a specified temperature, multiply the thermistor resistance at 25°C by the factor opposite the desired temperature.

Contact the plant for application assistance. Chances are we may have already supplied thermistors for similar applications. Our technical staff will be pleased to help you.

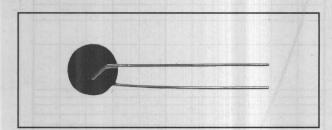
HOW TO ORDER

1B07 PART NUMBER ± 10% TOLERANCE

MODEL 1D NTC Thermistors

Uncoated Disc, Material 'D', 25 Ω to 5,000 Ω





APPLICATIONS

Engineered for

- Temperature compensation
- Temperature measurement
- Temperature control
- Meter compensation
- Voltage regulation

- Amplitude control
- Liquid level indication
- Flow measurement
- Surge suppression
- Time delay

@ 25°C ± 10% (Ohms)	PART NUMBER	DISSIPATION * CONSTANT	THERMAL** TIME CONSTANT	A	В	LEADS AWG #	[Numbers in brackets indicate millimeters]
5000	1D07	2	3	.050 [1.27]	.080 [2.03]	30	A (•
4000	1D08	2	3	.050 [1.27]	.070 [1.78]	30	Tinned Copper Wire
3000	1D09	2	3	.050 [1.27]	.050 [1.27]	30	
2000	1D10	2	2	.050 [1.27]	.030 [.762]	30	1.50
1500	1D11	2	2	.050 [1.27]	.025 [.635]	30	[38.10]
1000	1D12	2	2	.050 [1.27]	.020 [.508]	30	В
3000	1D120	2.5	5	.070 [1.78]	.100 [2.54]	30	SE PASE A LE PASE DE LA CONTRE
2500	1D125	2	4.5	.070 [1.78]	.085 [2.16]	30	
2000	1D110	2	4	.070 [1.78]	.070 [1.78]	30	(
1500	1D111	2	3	.070 [1.78]	.050 [1.27]	30	Composition "1D" thermistors are a part of a
1000	1D112	2	3	.070 [1.78]	.030 [7.27]	30	family of thermal sensors representing a new
							breakthrough in materials engineering.
1500	1D113	4	14	.100 [2.54]	.100 [2.54]	28	After more than a decade of engineering
1250	1D115	4	12	.100 [2.54]	.085 [2.16]	28	
1000	1D13	3	10	.100 [2.54]	.070 [1.78]	28	development and constant product
800	1D14	3	8	.100 [2.54]	.050 [1.27]	28	improvement, Techno Components has
700	1D145	3	7	.100 [2.54]	.045 [1.14]	28	formulated a thermal sensing material
600	1D147	3	7	.100 [2.54]	.040 [1.02]	28	called THERMOCERAM. The "1D"
500	1D15	3	6	.100 [2.54]	.030 [.762]	28	composition offers a broad range of
400	1D165	3	5	.100 [2.54]	.030 [.762]	28	composition offers a broad range of
300	1D16	3	5	.100 [2.54]	.020 [.508]	28	resistance values. The design engineer can
1000	1D151	7	30	.150 [3.81]	.150 [3.81]	24	specify from 25 ohms to 5,000 ohms from th
750	1D152	7	25	.150 [3.81]	.100 [2.54]	24	same basic type of thermistor. In addition to
500	1D153	7	20	.150 [3.81]	.075 [1.91]	24	this wide range of values, the Model "1D" is
250	1D154	7	18	.150 [3.81]	.040 [1.02]	24	an excellent, highly stable, broad application
800	1D118	8	40	.200 [5.08]	.200 [5.08]	24	thermal sensor that finds use in innumerable
750	1D117	8	36	.200 [5.08]	.190 [4.83]	24	
500	1D18	7	30	.200 [5.08]	.130 [3.30]	24	heat sensing designs.
300	1D10	7	25	.200 [5.08]	.080 [2.03]	24	Although not Military Qualified, all Model "1D
200	1D20	7	20	.200 [5.08]	.050 [2.03]	24	thermistors conform to AQL and confidence
150	1D205	7	19	.200 [5.08]	.040 [1.02]	24	
100	1D203	7	18	.200 [5.08]	.030 [.762]	24	levels as specified in MIL-T-23648 as
							outlined by tables V and VI.
300	1D22	9	75	.300 [7.62]	.180 [4.57]	24	Coatings, encapsulations markings, probes
200	1D225	8.5	60	.300 [7.62]	.120 [3.05]	24	and resistor/thermistor networksare also
100	1D23	8	48	.300 [7.62]	.060 [1.52]	24	
75	1D235	8	42	.300 [7.62]	.045 [1.14]	24	available to meet specific requirements by
50	1D24	8	35	.300 [7.62]	.030 [.762]	24	contacting our application engineering
150	1D119	10	85	.400 [10.16]	.160 [4.06]	22	department.
125	1D265	10	77	.400 [10.16]	.130 [3.30]	22	
100	1D26	9	70	.400 [10.16]	.100 [2.54]	22	Resistance tolerances of \pm 1% thru \pm 20%
75	1D27	9	65	.400 [10.16]	.080 [2.03]	22	are available and may be specified at 25°
50	1D28	9	50	.400 [10.16]	.050 [1.27]	22	or any temperature within the operating
25	1D33	14	60	.500 [12.70]	.040 [1.02]	22	range.

^{*} Dissipation Constant, expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

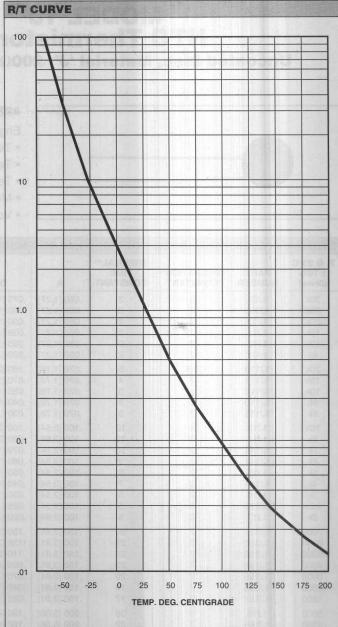
^{**} Thermal Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

MODEL 1D

R/T CONVERSION TABLE Rt/R25

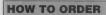
Ratio R @ 0°C 6.9 ± 3% Temperature Coefficient @ 25°C - 3.9%/°C Beta (25° to 75°C) 3530°K

12 12 1	E	seta (25° t	0 /5°C) 3	N USCC			12.2
TEMP °C	Rt/ R25	TEMP °C	Rt/ R25	TEMP °C	Rt/ R25	TEMP °C	Rt/ R25
- 55	53.40	- 3	3.222	49	.4225	101	.0921
- 54	50.10	-2	3.079	50	.4086	102	.0898
- 53	47.02	-1	2.944	51	.3953	103	.0875
- 52	44.16	0	2.815	52	.3824	104	.0853
- 51	41.48	100	2.692	53	.3700	105	.0832
- 50	38.99	2	2.576	54	.3581	106	.0811
- 49	36.66	3	2.465	55	.3467	107	.0792
- 48	34.48	4	2.360	56	.3356	108	.0772
- 47	32.45	5	2.260	57	.3250	109	.0753
- 46	30.55	6	2.164	58	.3147	110	.0735
- 45	28.77	7	2.074	59	.3049	111	.0717
- 44	27.11	8	1.987	60	.2954	112	.0700
- 43	25.55	9	1.905	61	.2862	113	.0683
- 42	24.09	10	1.826	62	.2774	114	.0667
- 41	22.73	11	1.751	63	.2689	115	.0651
- 40	21.45	12	1.680	64	.2607	116	.0636
- 39	20.25	13	1.612	65	.2528	117	.0621
- 38	19.13	14	1.547	66	.2451	118	.0607
- 37	18.07	15	1.485	67	.2378	119	.0593
- 36	17.08	16	1.426	68	.2306	120	.0579
- 35	16.15	17	1.370	69	.2238	121	.0566
- 34	15.28	18	1.316	70	.2172	122	.0553
- 33	14.46	19	1.264	71	.2108	123	.0540
- 32	13.68 12.96	20 21	1.215	72 73	.2046	124 125	.0528
- 30	12.90	22	1.123	74	.1929	126	.0504
- 29	11.63	23	1.080	75	.1873	127	.0493
- 28	11.03	24	1.039	76	.1820	128	.0482
- 27	10.46	25	1.000	77	.1768	129	.0471
- 26	9.918	26	.9624	78	.1717	130	.0461
- 25	9.411	27	.9265	79	.1669	131	.0451
- 24	8.934	28	.8921	80	.1622	132	.0441
- 23	8.483	29	.8591	81	.1577	133	.0431
- 22	8.058	30	.8276	82	.1533	134	.0422
- 21	7.657	31	.7973	83	.1490	135	.0413
- 20	7.278	32	.7684	84	.1449	136	.0404
- 19	6.920	33	.7406	85	.1410	137	.0395
- 18	6.582	34	.7140	86	.1371	138	.0387
- 17	6.263	35	.6885	87	.1334	139	.0379
- 16	5.960	36	.6641	88	.1298	140	.0371
- 15	5.675	37	.6406	89	.1263	141	.0363
- 14	5.404	38	.6181	90	.1229	142	.0355
- 13	5.148	39	.5965	91	.1197	143	.0348
- 12	4.906	40	.5758	92	.1165	144	.0341
- 11	4.676	41	.5559	93	.1134	145	.0334
- 10	4.459	42	.5368	94	.1105	146	.0327
-9	4.253	43	.5185	95	.1076	147	.0320
- 8	4.058	44	:5008	96	.1048	148	.0314
-7	3.872	45	.4839	97	.1021	149	.0307
- 6 - 5	3.697 3.530	46 47	.4676	98	.0995	150	.0301
- 5	3.530	47	.4520	100	.0969	18	
	0.072	40	.4370	100	.0343		TIS



To determine the resistance of a thermistor at a specified temperature, multiply the thermistor resistance at 25°C by the factor opposite the desired temperature.

Contact the plant for application assistance. Chances are we may have already supplied thermistors for similar applications. Our technical staff will be pleased to help you.



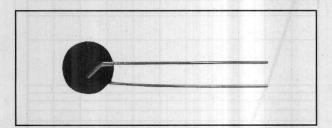
1D07 PART NUMBER

± 10% TOLERANCE

MODEL 1J NTC Thermistors

Uncoated Disc, Material 'J', 200 Ω to 30,000 Ω





APPLICATIONS

Engineered for

- Temperature compensation
- Temperature measurement
- Temperature control
- Meter compensation
- Voltage regulation

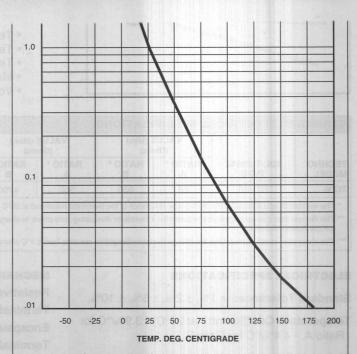
- Amplitude control
- Liquid level indication
- Flow measurement
- Surge suppression
- Time delay

@ 25°C ± 10% (Ohms)	PART NUMBER	DISSIPATION * CONSTANT	THERMAL** TIME CONSTANT	A	В	LEADS AWG#	[Numbers in brackets indicate millimeters]
30k	1J09	2	3	.050 [1.27]	.075 [1.91]	30	A (
25k	1J095	2	3	.050 [1.27]	.060 [1.52]	30	1 / /
20k	1J10	2	3	.050 [1.27]	.050 [1.27]	30	Tinned Copper Wire
15k	1J11	2	2	.050 [1.27]	.035 [.889]	30	and ages of the same of the sa
10k	1J12	2	2	.050 [1.27]	.025 [.635]	30	
8k	1J01	2	2	.050 [1.27]	.020 [.508]	30	[38.10]
20k	1J110	2:5	5	.070 [1.78]	.100 [2.54]	30	В
15k	1J111		4	.070 [1.78]	.070 [1.78]	30	Harris A
10k	1J112	2 2	3	.070 [1.78]	.050 [1.27]	30	
8k	1J113	2	3	.070 [1.78]	.040 [1.02]	30	
6k	1J115	2	3	.070 [1.78]	.030 [.762]	30	0 11 (4 17 11
		4	12		The state of the s	AND THE RESERVE	Composition "1J" thermistors are a part of a
10k	1J13		2000	.100 [2.54]	.100 [2.54]	28	family of thermal sensors representing a ne
8k	1J14	3	10	.100 [2.54]	.080 [2.03]	28	breakthrough in materials engineering.
7k	1J145	3	10	.100 [2.54]	.070 [1.78]	28	After more than a decade of engineering
6k	1J147	3	9	.100 [2.54]	.060 [1.52]	28	development and constant product
5k	1J15	3 3	8 7	.100 [2.54]	.050 [1.27]	28	
4k	1J165	3		.100 [2.54]	.040 [1.02]	28	improvement, Techno Components has
3k	1J16		5	.100 [2.54]	.030 [.762]	28	formulated a thermal sensing material
2.5k	1J175	3	5	.100 [2.54]	.025 [.635]	28	called THERMOCERAM. The "1J"
2k	1J17	3	5	.100 [2.54]	.020 [.508]	28	composition offers a broad range of
7000	1J151	7	30	.150 [3.81]	.150 [3.81]	24	resistance values. The design engineer ca
6000	1J152	7	28	.150 [3.81]	.135 [3.43]	24	
5000	1J153	7	25	.150 [3.81]	.110 [2.79]	24	specify from 200 ohm to 30,000 ohm from
4000	1J154	7	23	.150 [3.81]	.090 [2.29]	24	the same basic type of thermistor. In
3000	1J155	7	20	.150 [3.81]	.070 [1.78]	24	addition to this wide range of values, the
2000	1J156	7	19	.150 [3.81]	.045 [1.14]	24	Model "1J" is an excellent, highly stable,
1500	1J157	7	17	.150 [3.81]	.035 [.889]	24	broad application thermal sensor that finds
5000	1J18	8	36	.200 [5.08]	.190 [4.83]	24	
4000	1J185	7	32	.200 [5.08]	.160 [4.06]	24	use in innumerable heat sensing designs.
3000	1J19	7	30	.200 [5.08]	.120 [3.05]	24	Although not Military Qualified, all Model "1
2500	1J195	7	28	.200 [5.08]	.100 [2.54]	24	thermistors conform to AQL and confidence
2000	1J20	7	25	.200 [5.08]	.080 [2.03]	24	levels as specified in MIL-T-23648 as
1500	1J205	7	23	.200 [5.08]	.060 [1.52]	24	
1000	1J21	7	18	.200 [5.08]	.040 [1.02]	24	outlined by tables V and VI.
2000	1J23	9	75	.300 [7.62]	.180 [4.57]	24	Coatings, encapsulations markings, probes
1500	1J23 1J235	9	75	* A PACKET SAFETY SECTION SECT	at the second control of the second control	24	and resistor/thermistor networksare also
1000	1J235 1J24	8	48	.300 [7.62]	.135 [3.43]	24	available to meet specific requirements by
	1J24 1J245	8	48	.300 [7.62]	.080 [2.03]	24	
750		8	A TANK OLD BY DESCRIPTION OF THE PARTY.	.300 [7.62]	.070 [1.78]	The second secon	contacting our application engineering
500	1J119		35	.300 [7.62]	.045 [1.14]	24	department.
1000	1J26	10	85	.400 [10.16]	.160 [4.06]	22	Resistance tolerances of ± 1% thru ± 20°
750	1J27	9	70	.400 [10.16]	.120 [3.05]	22	
500	1J28	9	65	.400 [10.16]	.080 [2.03]	22	are available and may be specified at 25
250	1J29	9	50	.400 [10.16]	.040 [1.02]	22	or any temperature within the operating
200	1J35	14	60	.500 [12.70]	.050 [1.27]	22	range.

^{*} Dissipation Constant, expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

^{**} Thermal Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

	77.02		2.102	U.	.2401	114	.040//
- 44	44.18	9	2.089	62	.2317	115	.04454
- 43	41.26	10	1.990	63	.2236	116	.04335
- 42	38.56	11	1.897	64	.2158	117	.04219
- 41	36.05	12	1.809	65	.2084	118	.04108
- 40	33.72	13	1.726	66	.2012	119	.03999
- 39	31.55	14	1.647	67	.1944	120	.03894
- 38	29.54	15	1.571	68	.1878	121	.03793
- 37	27.67	16	1.500	69	.1814	122	.03694
- 36	25.93	17	1.432	70	.1753	123	.03598
- 35	24.31	18	1.368	71	.1695	124	.03506
- 34	22.80	19	1.307	72	.1638	125	.03416
- 33	21.39	20	1.249	73	.1584	126	.03329
- 32	20.08	21	1.194	74	.1532	127	.03244
- 31	18.86	22	1.142	75	.1482	128	.03162
- 30	17.72	23	1.092	76	.1433	129	.03083
- 29	16.65	24	1.045	77	.1387	130	.03005
- 28	15.66	25	1.000	78	.1342	131	.02930
- 27	14.73	26	.9572	79	.1299	132	.02858
- 26	13.86	27	.9165	80	.1258	133	.02787
- 25	13.05	28	.8777	81	.1218	134	.02718
- 24	12.29	29	.8408	82	.1179	135	.02652
- 23	11.58	30	.8056	83	.1142	136	.02587
- 22	10.92	31	.7721	84	.1106	137	.02524
- 21	10.30	32	.7402	85	.1072	138	.02464
- 20	9.713	33	.7098	86	.1039	139	.02404
- 19	9.166	34	.6808	87	.1007	140	.02347
- 18	8.654	35	.6531	88	.09759	141	.02291
- 17	8.173	36	.6267	89	.09461	142	.02236
- 16	7.722	37	.6015	90	.09174	143	.02184
- 15	7.298	38	.5774	91	.08897	144	.02132
- 14	6.900	39	.5545	92	.08630	145	.02082
- 13	6.526	40	.5326	93	.08372	146	.02034
- 12	6.175	41	.5116	94	.08123	147	.01987
- 11	5.845	42	.4916	95	.07882	148	.01941
- 10	5.534	43	.4725	96	.07650	149	.01896
- 9	5.242	44	.4543	97	.07426	150	.01853
- 8	4.967	45	.4368	98	.07209		



To determine the resistance of a thermistor at a specified temperature, multiply the thermistor resistance at 25°C by the factor opposite the desired temperature.

Contact the plant for application assistance. Chances are we may have already supplied thermistors for similar applications. Our technical staff will be pleased to help you.

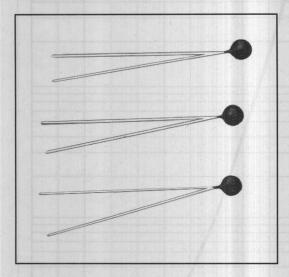
HOW TO ORDER

1J09 PART NUMBER ± 10%
TOLERANCE

MODEL TC06 NTC Thermistors



MIL-T-23648 Qualified, Type RTH High Stability, Thermoceram Thermistors, 0.5W at 25°C



FEATURES

- Qualified to MIL-T-23648
- · Designed for unlimited operating life
- Large resistance changes with minute body temperature changes
- · Additional testing can be performed as specified by customer

APPLICATIONS

These high stability thermistors were specifically designed for military applications. The characteristics of this material provide high reliability, small size (allowing for low time constants), extremely high temperature coefficients and close tolerances. Commonly used in the following applications:

- Temperature Compensation
- Temperature Measurement
- Temperature Control
- Meter Compensation
- Voltage Regulation
- Amplitude Control
- Liquid Level Indication
- Flow Measurement
- Surge Suppression
- Time Delay

STANDARD ELECTRICAL SPECIFICATIONS											
TECHNO MIL-T-23648 MODEL TYPE	VALUE (Min.) (Ohms)		VALUE (Oh		POWER RATING	MAXIMUM ** THERMAL TIME	MINIMUM *** DISSIPATION				
	RATIO *	RATIO *	RATIO *	RATIO *	@ + 25°C (Watts)	CONSTANT (Sec)	CONSTANT (mW/°C)				
TC06	RTH06	68	680	560	4700	0.5	80	5.0			

- * The resistance ratio is equal to the zero-power resistance of the thermistor measured at 25°C divided by the zero-power resistance measured at 125°C.
- ** The thermal time constant is the time required for a thermistor dissipating zero-power to change 63% of the difference between its initial temperature value and that of a new temperature environment.
- *** The dissipation constant measures the change in power dissipation resulting from a 1°C change in body temperature from a specified ambient temperature.

ELECTRICAL SPECIFICATIONS

Standard Tolerance: $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$.

Temperature Coefficient: (at 25°C) - 3.9%/°C for

Ratio A, - 4.4%/°C for Ratio B.

Dielectric Strength: 500 V, 2 minutes.

Insulation Resistance: Not less than 500 Megohm.

MECHANICAL SPECIFICATIONS

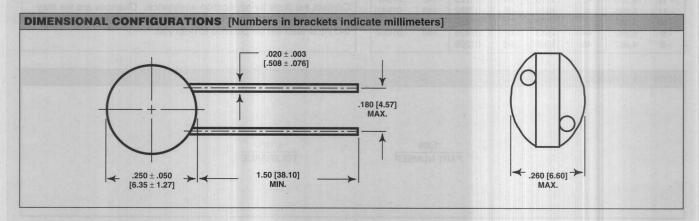
Resistive Element: Various metal oxides.

Terminals: Tinned metals.

Encapsulation: Epoxy and synthetic organic materials available. **Terminal Strength:** Direct load applied gradually to 4.5 pounds.

Solderability: Meets MIL-STD-202, Method 208.

Environmental Temperature Limits: - 55°C to + 125°C.



MODEL TC06

ENVIRONMENTAL PERF	ORMAN	CE CONTRACTOR OF THE CONTRACTO		Problem and the
TEST:		CONDITIONS	MIL-T-23648 REQUIREMENTS	TYPICAL CHANGE
Thermal Shock	(107)	5 cycles, - 65°C to + 125°C	ΔR ≤ 2.0%	ΔR < 1.00%
Short Time Overload		Maximum power for 2.5 hours in 5"/10" cycles	ΔR ≤ 2.0%	ΔR < 0.80%
Low Temperature Storage		- 65°C, no load, for 3 hours	ΔR ≤ 2.0%	ΔR < 0.45%
High Temperature Exposure		1000 hours, no load, at 125°C	ΔR ≤ 2.0%	ΔR < 0.55%
Moisture Resistance	(106)	240 hours with humidity ranging from 80% RH to 98% RH	ΔR ≤ 5.0%	ΔR < 2.00%
Resistance to Soldering Heat	(210)	300°C for 2.5 seconds	ΔR ≤ 1.0%	ΔR < 0.20%
Shock	(213)	20 shocks, 50G, 11 ms, half-sine, 2 axes	ΔR ≤ 2.0%	ΔR < 0.15%
Vibration	(204)	10 to 2000 Hz, 20G, 12 hours	ΔR ≤ 2.0%	ΔR < 0.90%
Load Life	(108)	1000 hours at rated power at 25°C 90"/30" cycles	ΔR ≤ 5.0%	ΔR < 1.50%

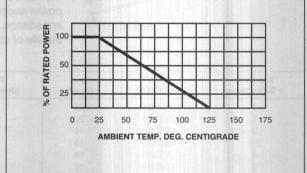
^{*} Numbers in parenthesis refer to test method of MIL-STD-202 as modified by the detail specification.

TEMP.	Ro (T)	Ro (T)
°C	RATIO A	RATIO B
- 55	54.90	100.0
- 50	38.95	67.0
- 40	21.51	33.7
- 30	12.33	17.7
- 21.5	alpege To-min to	10.6
- 20	7.307	9.71
- 10	4.476	5.53
0	2.825	3.27
10	1.830	1.99
20	1.216	1.25
25	1.000	1.00
30	.8267	.806
37.8	esauxoi n	.583
40	.5742	.533
50	.405	.360
60	.2937	.249
70	.2160	.175
75	.184	.148
80	.1615	.126
90	.1229	.0916
100	.0923	.0679
104.4		.0598
110	.0739	.0511
120	.0584	.0389
125	.0503	.0340

To determine the resistance of a thermistor at a specified temperature, multiply the thermistor resistance at 25°C by the factor opposite the desired temperature in the appropriate column.

DERATING

The maximum allowable power supplied to the thermistor must be derated linearly from an ambient temperature of + 25°C to the maximum operating temperature of + 125°C since the dissipation of electrical power causes a corresponding rise in body temperature.



PART MARKING

- Manufacturer's name or code
- Resistance value at + 25°C

HOW TO ORDER

MODEL RTH = General Purpose Thermistor

06 SIZE

body diameter

06 = .30 inch maximum

RESISTANCE RATIO $A = 19.8 \pm 10\%$ $B = 29.4 \pm 10\%$

LEAD STYLE S = Solderable W = Weldable

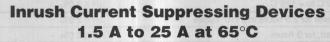
102 VALUE (25°C)

3 digit code. First two digits are significant figures. Last digit is number of zeros.

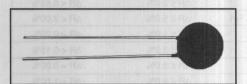
TOLERANCE

F = 1.0% G = 2.0%J = 5.0%K = 10.0%

MODEL "SOFT-START" NTC Thermistors





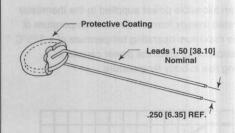


FEATURES

- · Switching power supply applications
- · Special marking is available upon request
- Protective silicone coating is standard and has a nominal thickness of .040" [1.0]. Other coatings are available upon request.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

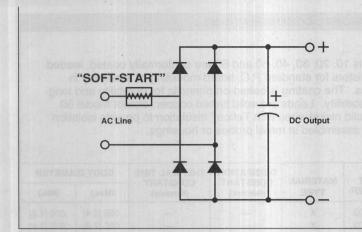
[Numbers in brackets indicate millimeters]

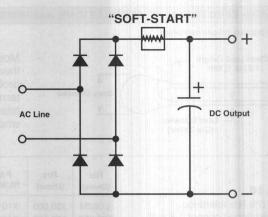


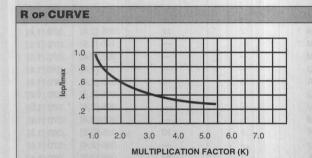
"Soft-Start" devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when AC or DC current begins to flow at lop.

Unlike circuit breakers and fuses, "Soft-Starts" prevent dangerous, short-duration, peak inrush currents present at turn-on. Especially useful in power supplies where charging capacitors initially present extremely low impedance. "Soft-Starts" actually limit inrush currents thereby extending the life of other critical components.

R o 25°C ± 20% (Ohms)	PART NUMBER	IMAX (Amps)	R @ IMAX (Ohms) Reference	MAXIMUM DIAMETER	MAXIMUM THICKNESS	LEAD DIAMETER
1	25SS25	25	.01	1.10 [27.9]	.35 [8.9]	.040 [1.02]
err 1 per est	20SS20	20	.015	.90 [22.9]	.30 [7.6]	.040 [1.02]
2	18SS36	18	.03	.90 [22.9]	.35 [8.9]	.040 [1.02]
2.5	15SS38	15	.03	.90 [22.9]	.30 [7.6]	.040 [1.02]
4	14SS56	14	.05	.90 [22.9]	.35 [8.9]	.040 [1.02]
5	12SS60	12	.06	.90 [22.9]	.50 [12.7]	.040 [1.02]
2.5	12SS30	12	.04	.90 [22.9]	.35 [8.9]	.040 [1.02]
5	10SS50	10	.06	.90 [22.9]	.35 [8.9]	.040 [1.02]
2.5	10SS25	10	.04	.90 [22.9]	.25 [6.4]	.040 [1.02]
5	9SS45	9	.06	.90 [22.9]	.25 [6.4]	.040 [1.02]
2.5	9SS23	9	.04	.90 [22.9]	.25 [6.4]	.040 [1.02]
5	8SS40	8	.05	.70 [17.8]	.25 [6.4]	.040 [1.02]
4	8SS32	8	.07	.70 [17.8]	.25 [6.4]	.040 [1.02]
5	7SS35	7	.07	.70 [17.8]	.25 [6.4]	.032 [.813]
2.5	7SS18	7	.05	.70 [17.8]	.25 [6.4]	.032 [.813]
10	6SS60	6	.15	.70 [17.8]	.35 [8.9]	.040 [1.02]
7	6SS42	6	.15	.60 [15.2]	.30 [7.6]	.040 [1.02]
5	6SS30	6	.07	.60 [15.2]	.25 [6.4]	.032 [.813]
10	5SS50	5	.20	.60 [15.2]	.35 [8.9]	.040 [1.02]
7	5SS35	5	.15	.60 [15.2]	.30 [7.6]	.040 [1.02]
4	5SS20	5	.15	.60 [15.2]	.25 [6.4]	.032 [.813]
12	4SS48	4	.22	.60 [15.2]	.30 [7.6]	.040 [1.02]
7	4SS28	4	.15	.60 [15.2]	.30 [7.6]	.040 [1.02]
5	4SS20	4	.15	.60 [15.2]	.25 [6.4]	.032 [.813]
10	3SS30	3	.20	.50 [12.7]	.30 [7.6]	.032 [.813]
7	3SS21	3	.14	.60 [15.2]	.25 [6.4]	.032 [.813]
5	3SS15	3	.17	.60 [15.2]	.25 [6.4]	.032 [.813]
2.5	3SS08	3	.15	.60 [15.2]	.25 [6.4]	.032 [.813]
40	2SS80	2	.60	.50 [12.7]	.25 [6.4]	.032 [.813]
20	2SS40	2 2	.28	.60 [15.2]	.25 [6.4]	.032 [.813]
10	2SS20	2	.20	.60 [15.2]	.25 [6.4]	.032 [.813]
5	2SS10	2	.40	.60 [15.2]	.25 [6.4]	.032 [.813]
60	1.5SS90	1.5	1.00	.50 [12.7]	.25 [6.4]	.032 [.813]
40	1.5SS60	1.5	.80	.50 [12.7]	.25 [6.4]	.032 [.813]
25	1.5SS38	1.5	.60	.50 [12.7]	.30 [7.6]	.032 [.813]
10	1.5SS15	1.5	.25	.50 [12.7]	.25 [6.4]	.032 [.813]



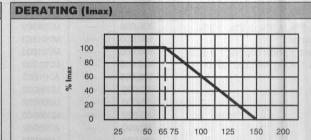




RESISTANCE OPERATING CHARACTERISTICS

When Techno Components "Soft-Starts" are employed at less than their rating, the approximate resistance of each device may be determined as follows:

- 1. Locate the point of the curve where the lop/Imax crosses the multiplication factor (K).
- 2. Multiply this factor by the value of R @ Imax for the device being used. The result will be the new R op (see R op Curve).



AMBIENT TEMPERATURE CHARACTERISTICS

For safe operation of a "Soft-Start" at temperatures above 65°C the percentage of I_{max} may be determined from I_{max} Derating Curve.

AMBIENT TEMP, DEG, CENTIGRADE

SPECIAL APPLICATIONS

Techno Components engineers will design "Soft-Start" devices for your special application. Outline your problem or specifications and send them to: Techno Components Applications Engineering Department.

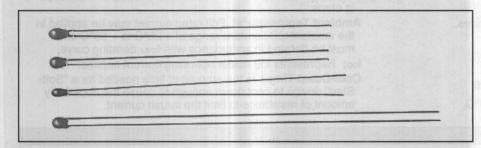
HOW TO ORDER

10SS25 PART NUMBER ± 10%

TOLERANCE (ONLY IF OTHER THAN ± 20%)

MODELS 10, 20, 30, 40, 50, 60 NTC Thermistors



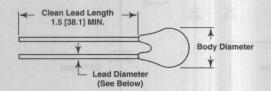


FEATURES

- Small size conformal coated
- · Wide resistance range
- Available in 7 different R-T curves
- Configured for standard P.C. board mounting or assembly in probes

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



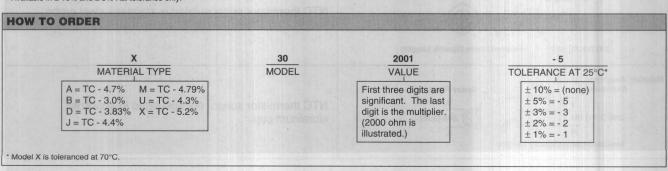
Models 10, 20, 30, 40, 50 and 60 are conformally coated, leaded thermistors for standard P.C. board mounting or assembly in probes. The coating is baked-on phenolic for durability and long-term stability. Leads are solid tinned copper, except Model 50 has solid nickel wires with Teflon® insulation to provide isolation when assembled in metal probes or housings.

	Ř25	B70	PART	MATERIAL	DISSIPATION	THERMAL TIME CONSTANT	BODY D	IAMETER
MODEL 10	(Ohms)	(Ohms)	NUMBER	TYPE	(Nominal)	(Nominal)	(Max.)	(Min.)
\pm 10%, \pm 5% R70 tolerance. Leads solid tinned copper 1.8 \pm .2 [45.7 \pm 5.1] long AWG30 (.0100").	1.082M 998.300	130,000 120,000	X101303 X101203	×	_	=	.095 [2.4] .095 [2.4]	.070 [1.8] .070 [1.8]
MODEL 20	1.0M	_	X201004*	X			.087 [2.2]	.061 [1.55]
± 10%, ± 5%, ± 3%, ± 2%, ± 1%	200,000	_	M202003	М	2	12	.095 [2.4]	.070 [1.8]
R ₂₅ tolerance.	150,000	_	M201503	M	-		.100 [2.5]	.075 [1.9]
Leads solid tinned copper $1.8 \pm .2$	100,000	201	M201003	M	- 110		.095 [2.4]	.070 [1.8]
45.7 ± 5.1] long AWG30 (.0100").	100,000		U201003	U	- 1111	<u> </u>	.095 [2.4]	.070 [1.8]
	100,000	-	A201003	A	2	12	.095 [2.4]	.070 [1.8]
	80,000	_	U208002	U			.095 [2.4]	.070 [1.8]
	50,000	_	U205002	U			.095 [2.4]	.070 [1.8]
	50,000	-	M205002	M			.095 [2.4]	.070 [1.8]
	50,000	-	A205002	A	2	10	.085 [2.2]	.060 [1.5]
	30,000	-	U203002	U	-		.095 [2.4]	.070 [1.8]
	30,000	-	A203002	A	2	10	.085 [2.2]	.060 [1.5]
	30,000		J203002	J	MINISTER		.095 [2.4]	.070 [1.8]
	25,000	-	J202502	J	pevolo in a en 6.1	Billian - Haller	.095 [2.4]	.070 [1.8]
	20,000	-	J202002	J	to does to some	lekkin s ur tinoson	.095 [2.4]	.070 [1.8]
	17,500		J201752	J	Section -	- 3000	.095 [2.4]	.070 [1.8]
	15,000		J201502	J		FASSING TO THE RESE	.095 [2.4]	.070 [1.8]
	10,000		J201002	J	2	10	.085 [2.2]	.060 [1.5]
	6,000	-	J206001	J	2	10	.085 [2.2]	.060 [1.5]
	5,000		J205001	J	2	10	.085 [2.2]	.060 [1.5]
	2,252	-	J202251	J	3	12	.095 [2.4]	.070 [1.8]
	2,000		D202001	D	3	12	.100 [2.5]	.075 [1.9]
	1,000	-	D201001	D	3	12	.085 [2.2]	.060 [1.5]

^{*} Available in \pm 10% and \pm 5% R25 tolerance only.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS R25										
[Numbers in brackets indicate millimeters]		C. 100 L. Destrict	The state of the s	CONSTANT	CONSTANT					
	500,000	X305003*			resease London T	.102 [2.6]	.073 [1.9			
MODEL 30	250,000	X302503*	X			.133 [3.4]	.102 [2.6			
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	150,000	X301503*	X			.163 [4.1]	.130 [3.3			
Leads solid tinned copper $1.8 \pm .2$	100,000	X301003*	X	-		.192 [4.9]	.157 [4.0			
[45.7 ± 5.1] long, AWG28 (.0126").	100,000	M301003	M	3	12	.095 [2.4]	.070 [1.8			
	50,000	M305002	M	3	12	.095 [2.4]	.070 [1.8			
	30,000	M303002	M	The case		.115 [2.9]	.090 [2.3			
	30,000	U303002	U	0.5		.095 [2.4]	.070 [1.8			
	30,000 20,000	A303002 U302002	A	2.5	12	.130 [3.3]	.100 [2.5			
	20,000	M302002	M			.130 [3.3]	.105 [2.7			
	20,000	A302002	A	3	12	.095 [2.4]	.070 [1.8			
	10,000	J301002	j	3	12	.095 [2.4]	.070 [1.8			
	9,000	J309001	J	3	12	.095 [2.4]	.070 [1.8			
	8,000	J308001	J	3 3	12	.095 [2.4]	.070 [1.8			
	7,000	J307001	J	3	12	.095 [2.4]	.070 [1.8			
	6,000	J306001	J	3	12	.095 [2.4]	.070 [1.8			
	4,000	J304001	J	3	12	.095 [2.4]	.070 [1.8			
	3,000	J303001	J	3	12	.095 [2.4]	.070 [1.8			
	2,000	J302001	J	3.5	16	.095 [2.4]	.070 [1.8			
	1,500	J301501	J			.135 [3.4]	.110 [2.8			
	1,250	J301251 J301001	J			.143 [3.7]	.120 [3.			
	1,000	D301001	D	3	12	.095 [2.4]	.075 [1.			
	900	D309000	D	3	12	.095 [2.4]	.075 [1.			
	800	D308000	D	3	12	.095 [2.4]	.075 [1.			
	700	D307000	D	3 3	12	.100 [2.5]	.075 [1.9			
	600	D306000	D	3	12	.100 [2.5]	.075 [1.9			
	500	D305000	D	3	12	.100 [2.5]	.075 [1.9			
	400	D304000	D	-		.120 [3.1]	.095 [2.4			
	300	D303000	D	2.5	10	.130 [3.3]	.105 [2.7			
	200 150	D302000 D301500	D	3.5	18	.150 [3.8] .165 [4.2]	.120 [3.1			
	100	D301000	D	4	20	.210 [5.3]	.180 [4.6			
	50	D305000	D			.272 [6.9]	.242 [6.2			
MODEL 40	15,000	J401502	j	0.8	5	.072 [1.8]	.050 [1.3			
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	10,000	J401002	J	0.8	5	.072 [1.8]	.050 [1.3			
Leads solid tinned copper 1.8 \pm .2	5,000	J405001	J	0.8	7	.072 [1.8]	.050 [1.3			
[45.7 ± 5.1] long, AWG32 (.0080").										
MODEL 50	100,000	U501003	U	ad Salamor Sa.		.095 [2.4]	.070 [1.8			
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	100,000	A501003 U505002	A	Starting of the		.095 [2.4] .095 [2.4]	.070 [1.8			
Leads Teflon® insulated solid nickel 3 ± .25	50,000	A505002	A	MES TASS		.085 [2.2]	.060 [1.			
[76.2 ± 6.4] long, AWG30 (.0100").	30,000	U503002	Û			.095 [2.4]	.070 [1.8			
[]	30,000	A503002	A	2	12	.085 [2.2]	.060 [1.			
	20,000	J502002	J	-		.095 [2.4]	.070 [1.			
	10,000	J501002	J	2	12	.085 [2.2]	.060 [1.			
	5,000	J505001	J	2 2	12	.085 [2.2]	.060 [1.			
	3,000 2,252	J503001 J502251	J	2 2	13 14	.095 [2.4] .095 [2.4]	.070 [1.8			
MODEL 60	50,000	X605002	X	hathla		.252 [6.4]	.216 [5.5			
± 10%, ± 5%, ± 3%, ± 2%, ± 1% R ₂₅ tolerance.	20,000	A602002	A	J villoed		.110 [2.8]	.090 [2.3			
	10,000	M601002	M	- 13	- 1	.190 [4.8]	.150 [3.8			
Leads solid tinned copper 1.8 ± .2	10,000	A601002	A	Market -		.135 [3.4]	.110 [2.8			
[45.7 ± 5.1] long, AWG26 (.0159").	10,000	J601002	J	-		.122 [3.1]	.085 [2.1			
	8,000	J608001	J			.120 [3.1]	.080 [2.0			
	3,000	J603001	J	THE RESERVE	TOTAL PARTY IN	.150 [3.8]	.110 [2.8			
	2,252 2,000	J602251 J602001	J		BURNET LINE	.160 [4.1] .160 [4.1]	.115 [2.9			
	500	D605000	D			.100 [4.1]	.085 [2.2			
	100	D601000	D	The Paris of the P		.270 [6.9]	.220 [5.6			
		D600500	D	180,010	Market Street,	.350 [8.9]	.295 [7.			

^{*} Available in \pm 10% and \pm 5% R25 tolerance only.



NTC Thermistors Temperature Sensing Probes



FEATURES

Temperature Range: -60°C to $+300^{\circ}\text{C}$. Sensors: NTC Thermistor ($-4.4\%^{\circ}\text{C}$).

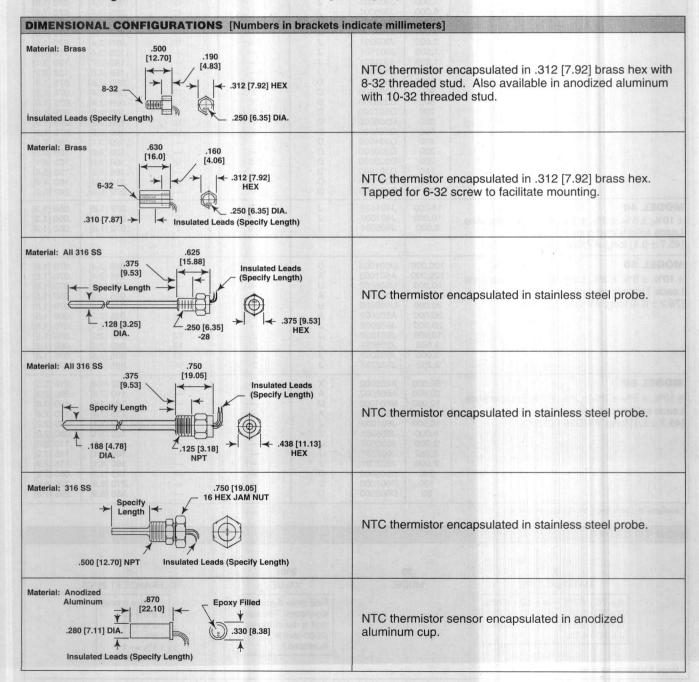
Tolerances: 10% to 0.5% or better

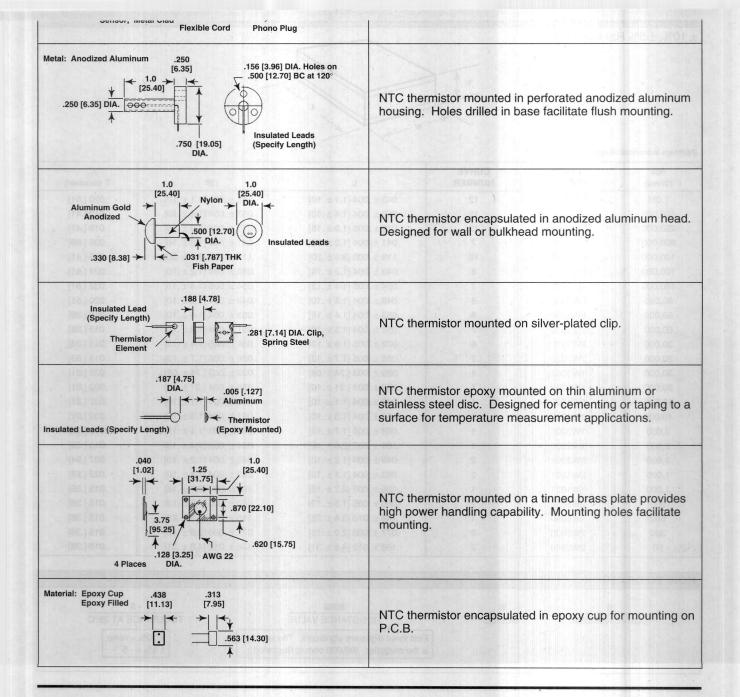
(interchangeable).

Resistance Range: 50 ohm or 350 kilohm at 25°C.

APPLICATIONS

Techno Components probes are designed for air, surface and liquid temperature measurement and control applications. Special industrial probes can be produced to customer specifications. Techno Components engineers will design Temperature Sensing Probes for your special application. Outline your problem or specifications and send them to Techno Components Applications Engineering Department.

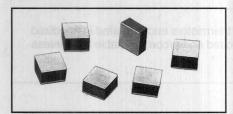




MODEL W NTC Thermistors

Surface Mount Chip



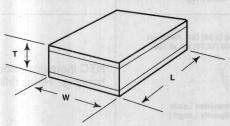


FEATURES

- Top and bottom surface terminations
- High-density monolithic ceramic construction
- Allows design flexibility for use with hybrid circuitry
- Model W is a thermistor die with silver conductors fired on the top and bottom surfaces. The bottom surface can be reflow soldered or conductive epoxied directly to a substrate bonding pad and the top surface wire bonded to complete the circuit connection.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

± 10%, ± 5% R25 tolerance



[Numbers in brackets indicate millimeters]

R ₂₅ (Ohms)	PART NUMBER	CURVE NUMBER	L	w	T (Nominal)
1.0M	12W1004	12	.043 ± .004 [1.1 ± .10]	.043 ± .004 [1.1 ± .10]	.020 [.51]
500,000	12W5003	12	.053 ± .004 [1.4 ± .10]	.053 ± .004 [1.4 ± .10]	.016 [.41]
250,000	12W2503	12	.075 ± .006 [1.9 ± .15]	.075 ± .006 [1.9 ± .15]	.016 [.41]
200,000	7W2003	7	.041 ± .004 [1.0 ± .10]	.041 ± .004 [1.0 ± .10]	.035 [.89]
100,000	12W1003	12	.119 ± .008 [3.0 ± .20]	.119 ± .008 [3.0 ± .20]	.016 [.41]
100,000	8W1003	8	.049 ± .004 [1.2 ± .10]	.049 ± .004 [1.2 ± .10]	.024 [.61]
100,000	7W1003	7	.054 ± .005 [1.4 ± .13]	.054 ± .005 [1.4 ± .13]	.032 [.81]
80,000	8W8002	8	.049 ± .004 [1.3 ± .10]	.049 ± .004 [1.2 ± .10]	.020 [.51]
50,000	8W5002	8	.053 ± .004 [1.4 ± .10]	.053 ± .004 [1.4 ± .10]	.015 [.38]
50,000	7W5002	7	.051 ± .004 [1.3 ± .10]	.051 ± .004 [1.3 ± .10]	.015 [.38]
30,000	8W3002	8	.072 ± .005 [1.8 ± .13]	.054 ± .005 [1.4 ± .13]	.013 [.33]
30,000	7W3002	7	.066 ± .005 [1.7 ± .13]	.066 ± .005 [1.7 ± .13]	.013 [.33]
30,000	1W3002	1	.029 ± .003 [.74 ± .08]	.029 ± .003 [.74 ± .08]	.032 [.81]
20,000	1W2002		.036 ± .004 [.91 ± .10]	.036 ± .004 [.91 ± .10]	.032 [.81]
15,000	1W1502	placed to be leafa	.042 ± .004 [1.1 ± .10]	.042 ± .004 [1.1 ± .10]	.032 [.81]
10,000	1W1002	in shirt to	.051 ± .004 [1.3 ± .10]	.051 ± .004 [1.3 ± .10]	.032 [.81]
3,000	1W3001	1	.068 ± .005 [1.7 ± .13]	.054 ± .005 [1.4 ± .13]	.015 [.38]
2,000	1W2001	1	.101 ± .007 [2.6 ± .18]	.054 ± .005 [1.4 ± .13]	.015 [.38]
2,000	2W2001	2	.049 ± .004 [1.2 ± .10]	.049 ± .004 [1.2 ± .10]	.037 [.94]
1,000	2W1001	2	.053 ± .004 [1.4 ± .10]	.053 ± .004 [1.4 ± .10]	.022 [.56]
1,000	1W1001	1	.105 ± .007 [2.7 ± .18]	.105 ± .007 [2.7 ± .18]	.015 [.38]
500	2W5000	2	.060 ± .005 [1.5 ± .13]	.060 ± .005 [1.5 ± .13]	.015 [.38]
500	1W5000	1	.148 ± .010 [3.8 ± .25]	.148 ± .010 [3.8 ± .25]	.015 [.38]
300	2W3000	2	.077 ± .006 [2.0 ± .15]	.077 ± .006 [2.0 ± .15]	.015 [.38]
50	2W0500	2	.188 ± .012 [4.8 ± .31]	.188 ± .012 [4.8 ± .31]	.015 [.38]

HOW TO ORDER

CURVE NUMBER

W MODEL 8002 RESISTANCE VALUE

First three digits are significant. The last digit is the multiplier. (80,000 ohm is illustrated.)

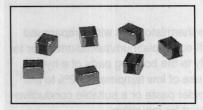
- 5 TOLERANCE AT 25°C

> $\pm 10\% = \text{none}$ $\pm 5\% = -5$

MODEL NTHS NTC Thermistors

Surface Mount Chip

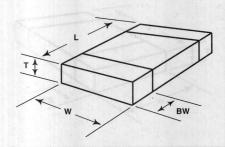




FEATURES

- Wraparound terminations
- · Allows design flexibility for use with hybrid circuitry
- High-density monolithic ceramic construction
- Available in 8mm tape and reel

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS



[Numbers in brackets indicate millimeters]

R ₂₅ * (Ohms)	PART ** NUMBER	CURVE NUMBER	L ± .008 [.20]	W ± .008 [.20]	T (Nominal)	BW ± .008 [.20]
5,000	NTHS-1206J02	2	.126 [3.2]	.063 [1.6]	.042 [1.1]	.018 [.46]
6,000	NTHS-1206J02	2	.126 [3.2]	.063 [1.6]	.035 [.89]	.018 [.46]
7,000	NTHS-1206J02	2	.126 [3.2]	.063 [1.6]	.030 [.76]	.018 [.46]
8,000	NTHS-1206J02	2	.126 [3.2]	.063 [1.6]	.027 [.69]	.018 [.46]
10,000	NTHS-1206J02	2	.126 [3.2]	.063 [1.6]	.022 [.56]	.018 [.46]
4,000	NTHS-1208J02	2	.126 [3.2]	.079 [2.0]	.041 [1.0]	.018 [.46]
3,000	NTHS-1210J02	2	.126 [3.2]	.098 [2.5]	.044 [1.1]	.018 [.46]
680	NTHS-1206J14	14	.126 [3.2]	.063 [1.6]	.027 [.69]	.018 [.46]
10,000	NTHS-1012N01	1	.098 [2.5]	.126 [3.2]	.065 [1.7]	.018 [.46]
100,000	NTHS-1205N01	1	.126 [3.2]	.049 [1.2]	.026 [.66]	.018 [.46]
50,000	NTHS-1206N01	1	.126 [3.2]	.063 [1.6]	.039 [.99]	.018 [.46]
10,000	NTHS-1206N02	2	.126 [3.2]	.063 [1.6]	.033 [.84]	.018 [.46]

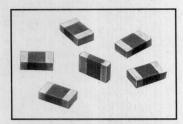
^{*} Consult factory for additional values.

HOW TO ORDER NTHS - 1206 N 02 10k ±5% or ±10% CONDUCTOR TYPE CURVE NUMBER R25 TOLERANCE H Conductor = Silver G Conductor = Palladium/Silver J Conductor = Platinum/Palladium/Silver N Conductor = Nickel Barrier

^{**} Part Number with J conductor also available with either H or G conductor.

MODEL J NTC Thermistors **Surface Mount Chip**





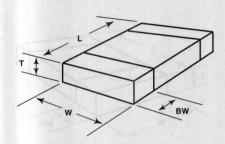
FEATURES

- · Wraparound terminations
- · Allows for design flexibility for use with hybrid circuitry
- · High-density monolithic ceramic construction
- · Available in 8mm tape and reel

· Model J chips are thermistor dies with wraparound terminations of fired-on platinum/palladium/silver for mounting directly to the bonding pads of a hybrid substrate. The use of low temperature 2% to 5% silver bearing solder paste or a suitable conductive epoxy is suggested for mounting.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

± 10%, ± 5% R25 tolerance



(Dimensions measured over termination) [Numbers in brackets indicate millimeters]

R ₂₅ (Ohms)	PART ** NUMBER	CURVE NUMBER	L ± .010 [.25]	W ± .005 [.13]	T (Nominal)	BW ± .008 [.20]
1.0 M*	7J1004	7 705 00	.102 [2.6]	.054 [1.4]	.014 [.36]	.018 [.46]
500,000	8J5003	8	.102 [2.6]	.053 [1.3]	.029 [.74]	.018 [.46]
100,000	1J1003	1 10 10	.107 [2.7]	.043 [1.1]	.016 [.41]	.018 [.46]
80,000	1J8002	1	.102 [2.6]	.053 [1.3]	.015 [.38]	.018 [.46]
60,000	1J6002	1	.102 [2.6]	.053 [1.3]	.019 [.48]	.018 [.46]
50,000	1J5002	1	.102 [2.6]	.051 [1.3]	.024 [.61]	.018 [.46]
40,000	1J4002	1	.102 [2.6]	.053 [1.3]	.028 [.71]	.018 [.46]
30,000	1J3002	1	.102 [2.6]	.060 [1.5]	.032 [.81]	.018 [.46]
15,000	2J1502	2	.102 [2.6]	.043 [1.1]	.016 [.41]	.018 [.46]
10,000	2J1002	2	.102 [2.6]	.051 [1.3]	.020 [.51]	.018 [.46]
8,000	2J8001	2	.102 [2.6]	.052 [1.3]	.024 [.61]	.018 [.46]
7,000	2J7001	2	.102 [2.6]	.056 [1.4]	.025 [.64]	.018 [.46]
6,000	2J6001	2	.102 [2.6]	.056 [1.4]	.029 [.74]	.018 [.46]
5,000	2J5001	2	.102 [2.6]	.058 [1.5]	.033 [.84]	.018 [.46]

^{*} Measured at 70°C. The value will be 144.7 kilohm.,

** Also available in Model H with silver and Model G with palladium/silver terminations.

IOW TO ORDER			
1	J	8002	- 5
CURVE NUMBER	MODEL	RESISTANCE VALUE	TOLERANCE AT 25°C
		First three digits are	± 10% = (none)
		significant. The last	± 5% = - 5
		digit is the mulitplier. (80,000 ohm is	
		illustrated.)	

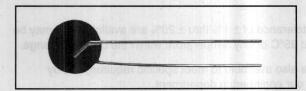
(Ohms)	NUMBER	CONSTANT	CONSTANT	AA	MATEBOO	AWG#	E ASSESSION I COMO
30k	NTHD-0050 B01	2	3	.050 [1.3]	.075 [1.9]	30	Which is the desired Herman Line (1998).
25k	NTHD-0050 B01	2	3	.050 [1.3]	.060 [1.5]	30	
20k	NTHD-0050 B01	2	3	.050 [1.3]	.050 [1.3]	30	The Best caoo cratical the cook
15k	NTHD-0050 B01	2	2	.050 [1.3]	.035 [.89]	30	PHILIPPEN CONTROL OF C
10k	NTHD-0050 B01	2	2	.050 [1.3]	.025 [.64]	30	
8k	NTHD-0050 B01	2	2	.050 [1.3]	.020 [.51]	30	
20k	NTHD-0070 B01	2.5	5	.070 [1.8]	.100 [2.5]	30	I son
15k	NTHD-0070 B01	2	40	.070 [1.8]	.070 [1.8]	30	
10k	NTHD-0070 B01	2	3	.070 [1.8]	.050 [1.3]	30	
8k	NTHD-0070 B01	2	3	.070 [1.8]	.040 [1.0]	30	\ \ \ \ \
6k	NTHD-0070 B01	2	3	.070 [1.8]	.030 [.76]	30	TOO STATE OF
10k	NTHD-0100 C01	4	12	.100 [2.5]	.100 [2.5]	28	CONTRACTOR TO SECURE
8k	NTHD-0100 C01	3	10	.100 [2.5]	.080 [2.0]	28	
7k	NTHD-0100 C01	3	10	.100 [2.5]	.070 [1.8]	28	
6k	NTHD-0100 C01	3	9	.100 [2.5]	.060 [1.5]	28	
5k	NTHD-0100 C01	3	8	.100 [2.5]	.050 [1.5]	28	
4k	NTHD-0100 C01	3	7			28	
				.100 [2.5]	.040 [1.0]		
3k	NTHD-0100 C01	3	5	.100 [2.5]	.030 [.76]	28	
2.5k	NTHD-0100 C01	3	5	.100 [2.5]	.025 [.64]	28	
2k	NTHD-0100 C01	3	5	.100 [2.5]	.020 [.51]	28	
7000	NTHD-0150 E01	7	30	.150 [3.8]	.150 [3.8]	24	10 12
6000	NTHD-0150 E01	7	28	.150 [3.8]	.135 [3.4]	24	100 08 16 CH
5000	NTHD-0150 E01	7	25	.150 [3.8]	.110 [2.8]	24	→ 1.5 ± .125 →
4000	NTHD-0150 E01	7	23	.150 [3.8]	.090 [2.3]	24	[38.1 ± 3.2]
3000	NTHD-0150 E01	7	20	.150 [3.8]	.070 [1.8]	24	[30.1 ± 3.2]
2000	NTHD-0150 E01	7	19	.150 [3.8]	.045 [1.1]	24	
1500	NTHD-0150 E01	7	17	.150 [3.8]	.035 [.89]	24	
5000	NTHD-0200 E01	8	36	.200 [5.1]	.190 [4.8]	24	
4000	NTHD-0200 E01	7	32	.200 [5.1]	.160 [4.1]	24	
3000	NTHD-0200 E01	7	30	.200 [5.1]	.120 [3.0]	24	A Little of Court of the Court
2500	NTHD-0200 E01	7	28	.200 [5.1]	.100 [2.5]	24	
2000	NTHD-0200 E01	7	25	.200 [5.1]	.060 [2.0]	24	
1500	NTHD-0200 E01	7	23	.200 [5.1]	.050 [2.0]	24	
1000	NTHD-0200 E01	7	18	.200 [5.1]	.040 [1.0]	24	
2000	NTHD-0300 E01	9	75			24	R
1500		9		.300 [7.6]	.180 [4.6]		
7 3 3 5 5	NTHD-0300 E01		70	.300 [7.6]	.135 [3.4]	24	
1000	NTHD-0300 E01	8	48	.300 [7.6]	.080 [2.0]	24	
750	NTHD-0300 E01	8	46	.300 [7.6]	.070 [1.8]	24	
500	NTHD-0300 E01	8	35	.300 [7.6]	.045 [1.2]	24	William Box State of the Control of
1000	NTHD-0400 F01	10	85	.400 [10.2]	.160 [4.1]	22	125 120 100 100 100 100 100
750	NTHD-0400 F01	9	70	.400 [10.2]	.120 [3.0]	22	
500	NTHD-0400 F01	9	65	.400 [10.2]	.080 [2.0]	22	
250	NTHD-0400 F01	9	50	.400 [10.2]	.040 [1.0]	22	

NTHD -	0050	В	01	30k	± 10%	CROSS/LOOP
MODEL	DISC DIAMETER	LEADS (AWG)	CURVE	R25	TOLERANCE	LEAD TYPE
		B = AWG 30 (.0100")				
		C = AWG 28 (.0126")				
		E = AWG 24 (.0201")				
		F = AWG 22 (.0253")				

PRELIMINARY - MODEL NTHD NTC Thermistors







FEATURES

- Resistance tolerance of \pm 1% thru \pm 20% are available and may be specified at 25°C or any temperature within the operating range.
- Coatings are also available to meet specific requirements by contacting our engineering department.

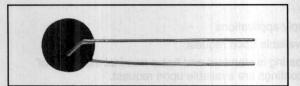
R at 25°C ± 10% (Ohms)	PART NUMBER	DISSIPATION CONSTANT	THERMAL TIME CONSTANT	A A 1	THERMAL TIME COBSTAN	LEADS AWG#	[Numbers in brackets indicate millimeters]
5000	NTHD-0050 B02	2	3	.050 [1.3]	.080 [2.0]	30	A CONTRACT OF SIDE
4000	NTHD-0050 B02	2	3	.050 [1.3]	.070 [1.8]	30	. TO CONTRACT THE NEXT
3000	NTHD-0050 B02	2	3	.050 [1.3]	.050 [1.3]	30	201011111111111111111111111111111111111
2000	NTHD-0050 B02	2	2	.050 [1.3]	.030 [.76]	30	
1500	NTHD-0050 B02	2	2	.050 [1.3]	.025 [.64]	30	The state of the s
1000	NTHD-0050 B02	2	2	.050 [1.3]	.020 [.51]	30	← Tinned Copper Wire
3000	NTHD-0070 B02	2.5	5	.070 [1.8]	.100 [2.5]	30	
2500	NTHD-0070 B02	2.5	4.5	.070 [1.8]	.085 [2.2]	30	4
	The second secon		4.5			30	
2000	NTHD-0070 B02	2		.070 [1.8]	.070 [1.8]	30	(°) \
1500	NTHD-0070 B02	2	3	.070 [1.8]	.050 [1.3]		
1000	NTHD-0070 B02	2	3	.070 [1.8]	.030 [.76]	30	
1500	NTHD-0100 C02	4	14	.100 [2.5]	.100 [2.5]	28	
1250	NTHD-0100 C02	4	12	.100 [2.5]	.085 [2.2]	28	
1000	NTHD-0100 C02	3	10	.100 [2.5]	.070 [1.8]	28	100 B 10-3 MM BERRE
800	NTHD-0100 C02	3	8	.100 [2.5]	.050 [1.3]	28	
700	NTHD-0100 C02	3	7	.100 [2.5]	.045 [1.1]	28	TO BY TO GRADUATE BY 282
600	NTHD-0100 C02	3	7	.100 [2.5]	.040 [1.0]	28	* E) 0 10 0 HINESIGN ANA
500	NTHD-0100 C02	3	6	.100 [2.5]	.030 [.76]	28	
400	NTHD-0100 C02	3	5	.100 [2.5]	.030 [.76]	28	IN THE POST OF THE
300	NTHD-0100 C02	3	5	.100 [2.5]	.020 [.51]	28	5 M 10 10 D-17
1000	NTHD-0150 E02	7	30	.150 [3.8]	.150 [3.8]	24	A (
750	NTHD-0150 E02	7	25	.150 [3.8]	.100 [2.5]	24	*
500	NTHD-0150 E02	7	20	.150 [3.8]	.075 [1.9]	24	1127 1021 (14) 111 1000
250	NTHD-0150 E02	7	18	.150 [3.8]	.040 [1.0]	24	★ 1.5 ± .125 → [38.1 ± 3.2]
800	NTHD-0200 E02	8	40	.200 [5.1]	.200 [5.1]	24	[30.1 ± 3.2]
750	NTHD-0200 E02	8	36	.200 [5.1]	.190 [4.8]	24	HE CERTIFIED IN THE COOR
500	NTHD-0200 E02	7	30	.200 [5.1]	.130 [3.3]	24	E00
400	NTHD-0200 E02	7	27	.200 [5.1]	.105 [2.7]	24	CONDUCTOR OF THE CONDUC
300	NTHD-0200 E02	7	25	.200 [5.1]	.080 [2.0]	24	000
270	NTHD-0200 E02	7	23	.200 [5.1]	.070 [1.8]	24	
200	NTHD-0200 E02	7	20	.200 [5.1]	.050 [1.3]	24	
150	NTHD-0200 E02	7	19	.200 [5.1]	.040 [1.0]	24	
100	NTHD-0200 E02	7	18	.200 [5.1]	.030 [.76]	24	The second control of the second
300	NTHD-0300 E02	9	75	.300 [7.6]	.180 [4.6]	24	The condition of the co
200	NTHD-0300 E02	8.5	60	.300 [7.6]	.120 [3.0]	24	В
100	NTHD-0300 E02	8.5	48	.300 [7.6]	.060 [1.5]	24	
75	NTHD-0300 E02	8	48	.300 [7.6]	.045 [1.5]	24	
50	NTHD-0300 E02	8	35	.300 [7.6]	.030 [.76]	24	
				6.47 600		ALL AND DESIGNATION OF THE PARTY OF THE PART	
150	NTHD-0400 F02	10	85	.400 [10.2]	.160 [4.1]	22	
125	NTHD-0400 F02	10	77	.400 [10.2]	.130 [3.3]	22	
100	NTHD-0400 F02	9	70	.400 [10.2]	.100 [2.5]	22	
75	NTHD-0400 F02	9	65	.400 [10.2]	.080 [2.0]	22	
50	NTHD-0400 F02	9	50	.400 [10.2]	.050 [1.3]	22	
25	NTHD-0500 F02	14	60	.500 [12.7]	.040 [1.0]	22	

HOW TO ORDER						
NTHD -	0050 DISC DIAMETER	B LEADS (AWG)	02 CURVE	5k R ₂₅	± 10% TOLERANCE	CROSS/LOOP LEAD TYPE
		B = AWG 30 (.0100") C = AWG 28 (.0126") E = AWG 24 (.0201")				
		F = AWG 22 (.0253")				

PRELIMINARY - MODEL NTHD NTC Thermistors

Uncoated Disc, Curve 14 Series = 2.5 Ω to 500 Ω

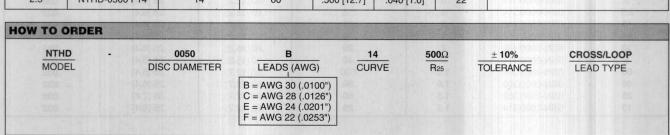




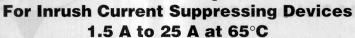
FEATURES

- Resistance tolerance of \pm 1% thru \pm 20% are available and may be specified at 25°C or any temperature within the operating range.
- Coatings are also available to meet specific requirements by contacting our engineering department.

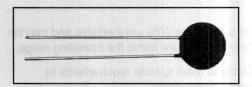
STANDAR	D ELECTRICAL	SPECIFICATIO	NS and DIM	ENSIONAL	CONFIGUR	RATIONS	
R at 25°C ± 10% (Ohms)	PART NUMBER	DISSIPATION CONSTANT	THERMAL TIME CONSTANT	r dealaes i	ale Be	LEADS AWG#	[Numbers in brackets indicate millimeters]
500	NTHD-0050 B14	2	3	.050 [1.3]	.080 [2.0]	30	
400	NTHD-0050 B14	2 2	3 3	.050 [1.3]	.070 [1.8]	30	
300	NTHD-0050 B14	2		.050 [1.3]	.050 [1.3]	30	
250	NTHD-0050 B14	2	2	.050 [1.3]	.040 [1.0]	30	MALLE CO. LEGISLAND CO.
200	NTHD-0050 B14	2	2	.050 [1.3]	.030 [.76]	30	
150	NTHD-0050 B14	2	2			30	→ Tinned Copper Wire
100	NTHD-0050 B14	2	2	.050 [1.3]	.025 [.64]	30	\
100	N1 HD-0050 B14	THE PROPERTY OF THE PARTY OF TH	a managana sa	.050 [1.3]	.020 [.51]	The Marine Property of the Party of the Part	*
300	NTHD-0070 B14	2.5	5	.070 [1.8]	.100 [2.5]	30	
250	NTHD-0070 B14	2	4.5	.070 [1.8]	.085 [2.2]	30	
200	NTHD-0070 B14	2	4 100	.070 [1.8]	.070 [1.8]	30	
150	NTHD-0070 B14	2	3	.070 [1.8]	.050 [1.3]	30	Troso, showa = 1
100	NTHD-0070 B14	2	3	.070 [1.8]	.030 [.76]	30	
150	NTHD-0100 C14	4	14	.100 [2.5]	.100 [2.5]	28	
125	NTHD-0100 C14	4	12	.100 [2.5]	.085 [2.2]	28	, 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
100	NTHD-0100 C14	3	10	.100 [2.5]	.070 [1.8]	28	
80	NTHD-0100 C14	3	8	.100 [2.5]	.050 [1.3]	28	
70	NTHD-0100 C14	3	7			28	
60	NTHD-0100 C14		7	.100 [2.5]	.045 [1.1]	28	
		3		.100 [2.5]	.040 [1.0]		Constitution to the property of the property o
50	NTHD-0100 C14	3	6	.100 [2.5]	.030 [.76]	28	
40	NTHD-0100 C14	3	5	.100 [2.5]	.030 [.76]	28	A (C
30	NTHD-0100 C14	3	5	.100 [2.5]	.020 [.51]	28	
100	NTHD-0150 E14	7	30	.150 [3.8]	.150 [3.8]	24	The state of the s
75	NTHD-0150 E14	7	25	.150 [3.8]	.100 [2.5]	24	→ 1.5 ± .125 →
50	NTHD-0150 E14	7	20	.150 [3.8]	.075 [1.9]	24	[38.1 ± 3.2]
25	NTHD-0150 E14	7	18	.150 [3.8]	.040 [1.0]	24	
80	NTHD-0200 E14	8	40	.200 [5.1]	.200 [5.1]	24	
75	NTHD-0200 E14	8	36	.200 [5.1]	.190 [4.8]	24	
50	NTHD-0200 E14	7	30	.200 [5.1]	.130 [3.3]	24	
30	NTHD-0200 E14	7	25	.200 [5.1]	.080 [2.0]	24	
20	NTHD-0200 E14	7	20	.200 [5.1]	.050 [1.3]	24	
15	NTHD-0200 E14	7	19	.200 [5.1]	.040 [1.0]	24	
10	NTHD-0200 E14	7	18	.200 [5.1]	.030 [.76]	24	
				Contract of the Contract of th		TO A STATE OF THE	
30	NTHD-0300 E14	9	75	.300 [7.6]	.180 [4.6]	24	+
20	NTHD-0300 E14	8.5	60	.300 [7.6]	.120 [3.0]	24	В
10	NTHD-0300 E14	8	48	.300 [7.6]	.050 [1.3]	24	
7.5	NTHD-0300 E14	8	42	.300 [7.6]	.045 [1.1]	24	
5 000	NTHD-0300 E14	8	35	.300 [7.6]	.030 [.76]	24	A A A CROSO (423) ESTA DE A SERVICIO
15	NTHD-0400 F14	10	85	.400 [10.2]	.160 [4.1]	22	50-00-3465
12.5	NTHD-0400 F14	10	77	.400 [10.2]	.130 [3.3]	22	
10	NTHD-0400 F14	9	70	.400 [10.2]	.100 [2.5]	22	
7.5	NTHD-0400 F14	9	65	.400 [10.2]	.080 [2.0]	22	
5	NTHD-0400 F14	9	50	.400 [10.2]	.050 [1.3]	22	
2.5	NTHD-0500 F14	14			THE RESERVE TO SERVE THE PARTY OF THE PARTY	SW College	
2.0	N1110-0300 F14	14	60	.500 [12.7]	.040 [1.0]	22	



MODEL SSN "SOFT-START" NTC Thermistors (Preliminary)





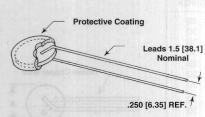


FEATURES

- · Switching power supply applications
- · Special marking is available upon request
- Protective silicone coating is standard and has a nominal thickness of .040" [1.0]. Other coatings are available upon request.

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

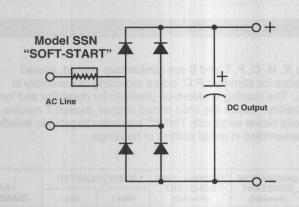
[Numbers in brackets indicate millimeters]

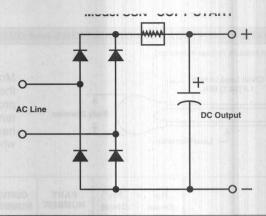


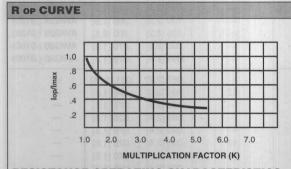
G = AWG 20 (.032") H = AWG 18 (.040") "Soft-Start" devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when AC or DC current begins to flow at lop.

Unlike circuit breakers and fuses, "Soft-Starts" prevent dangerous, short-duration, peak inrush currents present at turn-on. Especially useful in power supplies where charging capacitors initially present extremely low impedance. "Soft-Starts" actually limit inrush currents thereby extending the life of other critical components.

R o 25°C (Ohms)	MODEL	IMAX (Amps)	R @ IMAX (Ohms) Reference	MAXIMUM DIAMETER	MAXIMUM THICKNESS	LEAD DIAMETER
1	SSN-1100H14	25	.01	1.10 [27.9]	.35 [8.9]	.040
1	SSN-0900H14	20	.015	.90 [22.9]	.30 [7.6]	.040
2	SSN-0900H14	18	.03	.90 [22.9]	.35 [8.9]	.040
2.5	SSN-0900H14	15	.03	.90 [22.9]	.30 [7.6]	.040
4	SSN-0900H03	14	.05	.90 [22.9]	.35 [8.9]	.040
5	SSN-0900H03	12	.06	.90 [22.9]	.50 [12.7]	.040
2.5	SSN-0900H14	12	.04	.90 [22.9]	.35 [8.9]	.040
5	SSN-0900H03	10	.06	.90 [22.9]	.35 [8.9]	.040
2.5	SSN-0900H14	10	.04	.90 [22.9]	.25 [6.4]	.040
5	SSN-0900H03	9	.06	.90 [22.9]	.25 [6.4]	.040
2.5	SSN-0900H14	9	.04	.90 [22.9]	.25 [6.4]	.040
5	SSN-0700H14	8	.05	.70 [17.8]	.25 [6.4]	.040
4	SSN-0700H14	8	.07	.70 [17.8]	.25 [6.4]	.040
5	SSN-0700G14	7	.07	.70 [17.8]	.25 [6.4]	.032
2.5	SSN-0700G14	7	.05	.70 [17.8]	.25 [6.4]	.032
10	SSN-0700H03	6	.15	.70 [17.8]	.35 [8.9]	.040
7	SSN-0600H14	6	.15	.60 [15.2]	.30 [7.6]	.040
5	SSN-0600G14	6	.07	.60 [15.2]	.25 [6.4]	.032
10	SSN-0600H03	5	.20	.60 [15.2]	.35 [8.9]	.040
7	SSN-0600H14	5	.15	.60 [15.2]	.30 [7.6]	.040
4	SSN-0600G14	5	.15	.60 [15.2]	.25 [6.4]	.032
12	SSN-0600H03	4	.22	.60 [15.2]	.30 [7.6]	.040
7	SSN-0600H14	4	.15	.60 [15.2]	.30 [7.6]	.040
5	SSN-0600G14	4	.15	.60 [15.2]	.25 [6.4]	.032
10	SSN-0500G14	3	.20	.50 [12.7]	.30 [7.6]	.032
7	SSN-0600G14	3	.14	.60 [15.2]	.25 [6.4]	.032
5	SSN-0600G14	3	.17	.60 [15.2]	.25 [6.4]	.032
2.5	SSN-0600G14	3	.15	.60 [15.2]	.25 [6.4]	.032
40	SSN-0500G03	2	.60	.50 [12.7]	.25 [6.4]	.032
20	SSN-0600G03	2	.28	.60 [15.2]	.25 [6.4]	.032
10	SSN-0600H03	2	.20	.60 [15.2]	.25 [6.4]	.032
5	SSN-0600G14	2	.40	.60 [15.2]	.25 [6.4]	.032
60	SSN-0500G03	1.5	1.00	.50 [12.7]	.25 [6.4]	.032
40	SSN-0500G03	1.5	.80	.50 [12.7]	.25 [6.4]	.032
25	SSN-0500G03	1.5	.60	.50 [12.7]	.30 [7.6]	.032
10	SSN-0500G14	1.5	.25	.50 [12.7]	.25 [6.4]	.032



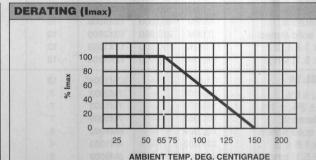




RESISTANCE OPERATING CHARACTERISTICS

When Dale Electronics, Inc. "Soft-Starts" are employed at less than their rating, the approximate resistance of each device may be determined as follows:

- Locate the point of the curve where the lop/Imax crosses the multiplication factor (K).
- 2. Multiply this factor by the value of R @ Imax for the device being used. The result will be the new R op (see R op Curve).

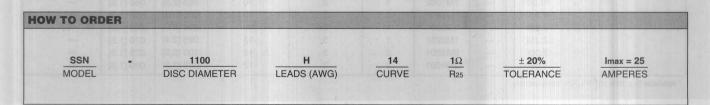


AMBIENT TEMPERATURE CHARACTERISTICS

For safe operation of a "Soft-Start" at temperatures above 65°C the percentage of I_{max} may be determined from I_{max} Derating Curve.

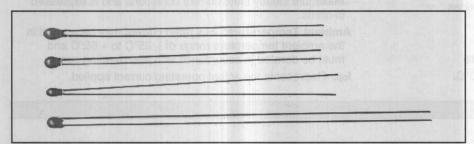
SPECIAL APPLICATIONS

Dale Electronics, Inc. engineers will design "Soft-Start" devices for your special application. Outline your problem or specifications and send them to: Dale Electronics, Inc. Applications Engineering Department.



MODELS X, M, C, F, T, B NTC Thermistors



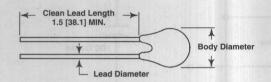


FEATURES

- Small size conformal coated
- Wide resistance range
- · Available in 11 different R-T curves
- Configured for standard P.C. board mounting or assembly in probes

STANDARD ELECTRICAL SPECIFICATIONS and DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



Models X, M, C, F, T and B are conformally coated, leaded thermistors for standard P.C. board mounting or assembly in probes. The coating is baked-on phenolic for durability and long-term stability. Leads are solid tinned copper, except T models have solid nickel wires with Teflon® insulation to provide isolation when assembled in metal probes or housings.

	R ₂₅	R70	PART	CURVE	DISSIPATION	THERMAL TIME	BODY D	IAMETER	LEAD
	(Ohms)	(Ohms)	NUMBER	NUMBER	(Nominal)	(Nominal)	(Max.)	(Min.)	DIAMETER
MODEL X	19.68M	1.6M	13X1604	13			.095 [2.4]	.070 [1.8]	AWG30 (.0100)
± 10%, ± 5%	9.84M	800,000	13X8003	13		_ 13	.095 [2.4]	.070 [1.8]	AWG28 (.0126)
R70 tolerance.	4.92M	400,000	13X4003	13	-	-	.100 [2.5]	.080 [2.0]	AWG28 (.0126)
Leads solid tinned	3.08M	250,000	13X2503	13			.125 [3.2]	.100 [2.5]	AWG28 (.0126
copper 1.8 ± .2	1.082M	130,000	12X1303	12		-	.095 [2.4]	.070 [1.8]	AWG30 (.0100
[45.7 ± 5.1] long.	998.300	120,000	12X1203	12	-	-	.095 [2.4]	.070 [1.8]	AWG30 (.0100)
MODEL M	1.0M		12M1004*	12			.087 [2.2]	.061 [1.55]	
± 10%, ± 5%,	200,000		7M2003	7	2	12	.095 [2.4]	.070 [1.8]	3 3
± 3%, ± 2%, ± 1%	150,000	_	7M1503	7	_		.100 [2.5]	.075 [1.9]	
R ₂₅ tolerance.	100,000	_	7M1003	7			.095 [2.4]	.070 [1.8]	_
Leads solid tinned	100,000		8M1003	8			.095 [2.4]	.070 [1.8]	_
copper 1.8 ± .2	100,000	av 88_00 a	4M1003	4	2	12	.095 [2.4]	.070 [1.8]	
[45.7 ± 5.1] long	80,000	at the last	8M8002	8		(A 80 m) A	.095 [2.4]	.070 [1.8]	
AWG30 (.0100").	50,000	-	8M5002	8			.095 [2.4]	.070 [1.8]	-
	50,000	_	7M5002	7			.095 [2.4]	.070 [1.8]	
	50,000		4M5002	4	2	10	.085 [2.2]	.060 [1.5]	DE ABO INSTAN
	30,000	THE ED Y	8M3002	8	141 -1 - CON	MARION OF SCHEN	.095 [2.4]	.070 [1.8]	HIST BOTH OUT
	30,000	_	4M3002	4	2	10	.085 [2.2]	.060 [1.5]	may be the larger
	30,000	-	1M3002	1	- 80	Badrio at Alfall St. (Cross	.095 [2.4]	.070 [1.8]	c education of
	25,000		1M2502	1			.095 [2.4]	.070 [1.8]	oli and
	20,000	W 92097	9M2002	9	2	10	.095 [2.4]	.070 [1.8]	SITE OF STREET
	20,000	i√ss - u0	1M2002	s is to the	Curven	u-A anatala Suca	.095 [2.4]	.070 [1.8]	
	17,500	di 2-100	1M1752	of mint be			.095 [2.4]	.070 [1.8]	_
	15,000	_	1M1502	1		- 1	.095 [2.4]	.070 [1.8]	<u> </u>
	10,000	_	9M1002	9	2	12	.095 [2.4]	.070 [1.8]	_
	10,000	_	1M1002	1	2	10	.085 [2.2]	.060 [1.5]	
	6,000	-	1M6001	1	2	10	.085 [2.2]	.060 [1.5]	-
	5,000	_	1M5001	1	2	10	.085 [2.2]	.060 [1.5]	
	2,252		1M2251	1	3	12	.095 [2.4]	.070 [1.8]	-
	2,000	_	2M2001	2	3	12	.100 [2.5]	.075 [1.9]	
	1,000	_ =	2M1001	2	3	12	.085 [2.2]	.060 [1.5]	MARKET TO THE

^{*} Available in \pm 10% and 5% R25 tolerance only.

				PIGURATION DISSIPATION	THERMAL TIME	BODY DI	AMETER
[Numbers in brackets indicate millimeters]	R ₂₅ (Ohms)	PART NUMBER	CURVE NUMBER	CONSTANT (Nominal)	CONSTANT (Nominal)	(Max.)	(Min.)
MODEL C	500,000	12Q5003*	12			.102 [2.6]	.073 [1.9
± 10%, ± 5%, ± 3%, ± 2%, ± 1% R ₂₅ tolerance.	250,000	12C2503*	12	-	- I	.133 [3.4]	.102 [2.6
Leads solid tinned copper 1.8 \pm .2	150,000	12C1503*	12			.163 [4.1]	.130 [3.3
	100,000	12C1003*	12	3	12	.192 [4.9] .095 [2.4]	.157 [4.0
[45.7 ± 5.1] long, AWG28 (.0126").	100,000 50,000	7C1003 7C5002	7 7	3	12	.095 [2.4]	.070 [1.8
	30,000	7C3002	7	_	12	.115 [2.9]	.090 [2.3
	30,000	8C3002	8	COLD THE NO		.095 [2.4]	.070 [1.8
	30,000	4C3002	4	2.5	12	.095 [2.4]	.070 [1.8
	20,000	8C2002	8	serio o de de consti	med 3° 4 or mail	.130 [3.3]	.100 [2.5
	20,000	7C2002	7	then stor	miles To Husto	.130 [3.3]	.105 [2.7
	20,000	4C2002 1C1002	4	3 3	12 - 12	.095 [2.4] .095 [2.4]	.070 [1.8
	9,000	1C9001	1 1	3	12	.095 [2.4]	.070 [1.8
	8,000	1C8001	1	3	12	.095 [2.4]	.070 [1.8
	7,000	1C7001	1	3	12	.095 [2.4]	.070 [1.8
	6,000	1C6001	1	3	12	.095 [2.4]	.070 [1.8
	4,000	1C4001	1	3	12	.095 [2.4]	.070 [1.8
	3,000	1C3001	OT DDA	3	12	.095 [2.4]	.070 [1.8
	2,000 1,500	1C2001 1C1501	t en	3.5	16	.095 [2.4]	.070 [1.8
	1,250	1C1251	1014 1.0%	Bis SEE Cha	mile is Extracte	.145 [3.7]	.120 [3.1
	1,000	1C1001	1		Ballion of the state of the state of	.158 [4.0]	.128 [3.2
	1,000	2C1001	2	3	12	.095 [2.4]	.075 [1.9
	900	2C9000	2	3	12	.095 [2.4]	.075 [1.9
	800	2C8000	2	3 3	12	.095 [2.4]	.075 [1.9
	700 600	2C7000 2C6000	2 2	3	12 12	.100 [2.5]	.075 [1.9
	500	2C5000	2	3	12	.100 [2.5]	.075 [1.9
	400	2C4000	2			.120 [3.1]	.095 [2.4
	300	2C3000	2			.130 [3.3]	.105 [2.7
	200	2C2000	2	3.5	18	.150 [3.8]	.120 [3.1
	150	2C1500 2C1000	2 2	4	20	.165 [4.2]	.135 [3.4
	50	2C0500	2	4	20	.210 [5.3] .272 [6.9]	.180 [4.6
MODEL F	30,000	9F3002	9	0.8	5	.072 [1.8]	.050 [1.3
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	15,000	1F1502	1	0.8	5 5	.072 [1.8]	.050 [1.3
Leads solid tinned copper 1.8 ± .2	10,000	1F1002	1	0.8	5	.072 [1.8]	.050 [1.3
[45.7 ± 5.1] long, AWG32 (.0080").	5,000	1F5001	1	0.8	7	.072 [1.8]	.050 [1.3
MODEL T	100,000	8T1003	8			.095 [2.4]	.070 [1.8
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	100,000	4T1003	4	- E		.095 [2.4]	.070 [1.8
Leads Teflon® insulated solid nickel 3 ± .25	50,000	8T5002	8			.095 [2.4]	.070 [1.8
76.2 ± 6.4] long, AWG30 (.0100").	50,000	4T5002 8T3002	8			.085 [2.2]	.060 [1.5
[10.2 ± 0.4] long, AVVaso (.0100).	30,000	4T3002	4	2	12	.085 [2.2]	.060 [1.5
	20,000	9T2002	9	2	12	.095 [2.4]	.070 [1.8
	20,000	1T2002	1		1-1-	.095 [2.4]	.070 [1.8
	10,000	9T1002	9	2 2 2	14	.095 [2.4]	.075 [1.9
	10,000	1T1002	1	2	12	.085 [2.2]	.060 [1.5
	5,000	1T5001 1T3001	1	2	12 13	.085 [2.2]	.060 [1.5
	2,252	1T2251	i	2	14	.095 [2.4]	.070 [1.8
MODEL B	50,000	12B5002	12			.252 [6.4]	.216 [5.5
\pm 10%, \pm 5%, \pm 3%, \pm 2%, \pm 1% R ₂₅ tolerance.	20,000	4B2002	4		= =	.110 [2.8]	.090 [2.3
Leads solid tinned copper 1.8 \pm .2	10,000	7B1002	7			.190 [4.8]	.150 [3.8
[45.7 ± 5.1] long, AWG26 (.0159").	10,000	4B1002 1B1002	4	A SHEET SHEET		.135 [3.4]	.110 [2.8
[40.7 ± 0.1] long, AVVa20 (.0109).	8,000	1B8001	1			.122 [3.1]	.085 [2.2
	3,000	1B3001	1			.150 [3.1]	.110 [2.8
	2,800	17B2801	17		_	.180 [4.6]	.150 [3.8
	2,252	1B2251	100 0100			.160 [4.1]	.115 [2.9
	2,000	1B2001	10	-		.160 [4.1]	.115 [2.9
	500 100	2B5000 2B1000	2 2	oet on		.125 [3.2] .270 [6.9]	.085 [2.2 .220 [5.6
				The second secon	CONTRACTOR OF THE PROPERTY OF	1.2/010.5	1.6 0 0.0

^{*} Available in \pm 10% and 5% R₂₅ tolerance only.

HOW TO ORDER	the spirit of the second			。 《11·14·14·14·14·14·14·14·14·14·14·14·14·1
1	4.83	<u>C</u>	2001	- 5
CURVE NUMBER		MODEL	VALUE	TOLERANÇE AT 25°C*
			First three digits are	± 10% = (none)
			significant. The last	± 5% = - 5
			digit is the multiplier.	± 3% = - 3
			(2000 ohm is	± 2% = - 2
Model X is toleranced at 70°C.			illustrated.)	± 1% = - 1

NTC (%/°C) VS. TEMPERATURE CURVES



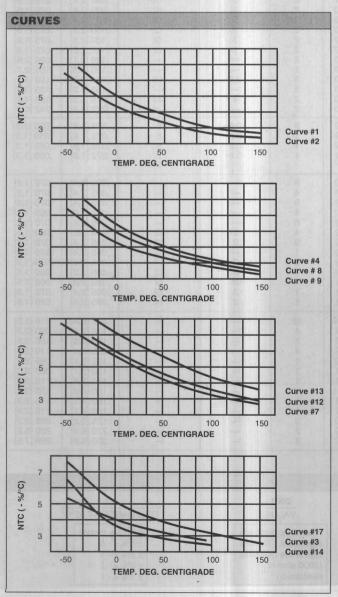
NTC (- %/°C) is negative temperature coefficient of resistance at temperature (T) expressed in % resistance change per °C. Since one NTC resistance change is approximately equivalent to 1°C temperature change, NTC is useful in developing curve tracking thermistor specifications (e.g., Curve 1, 10,000 ohm \pm 4.4% at 25°C; 32,660 ohm \pm 5.1% at 0°C 1753 ohm \pm 3.4% at 70°C results in a \pm 1°C: curve tracking thermistor 0° to 70°C, .5 NTC = \pm .5°C, etc.).

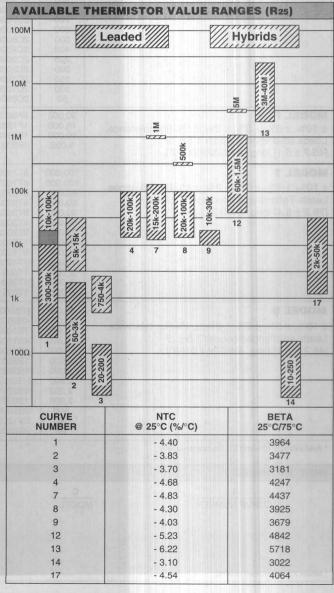
MT \pm % is manufacturing tolerance at temperature. Add to resistance tolerance specified at 25°C. (e.g., Curve 1, 10 kilohm \pm 10% at 25°C, 1258 ohm \pm 12.1% at 80°C.) Not applicable to curve tracking thermistors.

RT-R25 Ratio is resistance at temperature T divided by resistance at 25°C. To determine the resistance of a NTC thermistor at temperatures other than 25°C, multiply the ratio selected from the appropriate curve column above by resistance at 25°C (e.g., Curve 1, 10 kilohm at 25°C, 1258 ohm at 80°C).

NOTE: For 1°C Ratio Tables, see pages 223 to 227.

MAXIMUM TEMPERATURE for thermistors listed is 150°C; however, continuous operation or cycling above 125°C (curve tracking above the specified temperature range) may cause thermistors to exceed the originally specified tolerances.





80	.1258	2.1	3.2	.1622	5.1	2.8	.189	9.8	2.6	.1084	3.4	3.5
90	.09174	2.3	3.1	.1229	5.5	2.7	.147	11.2	2.5	.0771	3.9	3.3
100	.06798	2.6	2.9	.09446	6.7	2.6	.115	12.6	2.0	.0557	4.4	3.2
110	.05110	2.7	2.8	.07350	7.4	2.4	.0917	12.0	BB FIUC	.0408	4.9	3.0
120	.03894	3.2	2.7			2.4		100000				
125			2.7	.05788	8.5		.0733	The state of the state of		.0303	5.3	2.9
	.03416	3.3		.05158	8.7	2.3	.0660			.0263	5.5	2.9
130	.03005	3.4	2.5	.04609	8.9	2.2	.0593			.0228	5.7	2.8
140	.02347	3.7	2.4	.03708	9.7	2.1	.0487	201 + etc	real Times	.0173	6.0	2.7
150	.01853	01151/5-5		.03012			Park a Supple			.0133	Later Livery	
TEMP.		CURVE 7			CURVE 8		40.00	CURVE 9		PHILIP SHAPE	CURVE 12	
	RATIO	MT±%	NTC	RATIO	MT±%	NTC	RATIO	MT±%	NTC	RATIO	MT±%	NTC
- 55	126.1	6.0	7.6							176.4		8.0
- 50	86.92	5.0	7.3	56.49	3.5	6.9	44.13	3.9		119.0		7.8
- 40	42.69	4.2	6.9	29.49	3.0	6.3	23.98	3.3	5.9	55.98		7.3
- 30	21.84	2.9	6.5	16.03	2.4	5.9	13.52	2.6	5.6	27.45	The Salary Control	6.9
- 20	11.61	2.7	6.2	9.040	1.9	5.6	7.891	2.1	5.2	13.98	13.7	6.6
- 10	6.385	2.1	5.8	5.267	1.4	5.2	4.754	1.5	4.9	7.375	11.7	6.2
0	3.627	1.4	5.5	3.166	1.0	4.9	2.949	1.1	4.6	4.018	9.9	5.9
10	2.123	0.9	5.2	1.958	0.5	4.7	1.879	0.6	4.4	2.256	8.2	5.6
20	1.277	0.2	5.0	1.243	0.1	4.4	1.226	0.1	4.2	1.303	6.6	5.4
25	1.00	0.0	4.8	1.00	0.0	4.3	1.00	0.0	4.0	1.00	5.9	5.2
30	.7880	0.4	4.7	.8090	0.2	4.0	.8194	0.2	3.9	.7723	5.2	5.1
37	.5702		4.5	.6070			.6258	0.6	3.8	.5434	000012	4.9
40	.4981	0.9	4.5	.5383	0.6	3.7	.5592	0.7	3.7	.4690	3.7	4.9
50	.3219	1.5	4.3	.3657	1.0	3.6	.3893	1.1	3.5	.2914	2.4	4.6
60	.2124	1.9	4.1	.2533	1.2	3.4	.2760	1.3	3.4	.1849	1.1	4.4
70	.1429	2.4	3.9	.1786	1.6	3.2	.1990	1.8	3.2	.1198	0.0	4.2
80	.09790	2.7	3.7	.1281	1.9	3.1	.1458	2.1	3.1	.07902	1.0	4.
90	.06823	3.2	3.5	.09330		2.9		2.3				
100					2.1		.1084		2.9	.05307	2.1	3.9
	.04832	3.6	3.4	.06897	2.4	2.8	.08168	2.6	2.8	.03624	3.1	3.7
110	.03474	4.0	3.2	.05167	2.6	2.7	.06235	2.7	2.6	.02514	4.0	3.6
120	.02533	4.4	3.1	.03920	2.9	2.7	.04818	3.2	2.5	.01770	4.9	3.4
125	.02174	4.5	3.0	.03430	3.0	2.6	.04253	3.3	NEW PROPERTY.	.01493	5.3	3.4
130	.01872	4.7	3.0	.03010	3.1	2.5	.03764	3.4	2.4	.01264	5.8	3.3
140	.01401	5.0	2.8	.02337	3.4	2.4	.02972	3.7	2.3	.00915	6.6	3.2
150	.01061	OUDVE 40	2.7	.01834	3.5	2.3	.02370	01151/5 15		.00670	7.3	3.0
°C		CURVE 13			CURVE 14			CURVE 17				
	RATIO	MT±%	NTC	RATIO	MT±%	NTC	RATIO	MT±%	NTC			
- 55	503.0		9.7	31.9		SIND S						
- 50	312.0	1430	9.4	24.3	18.5	5.6	72.50	5.6	7.5			
- 40	125.0	Satisfal a	8.9	14.4	15.4	4.9	36.09	4.8	6.9	Line Date		
- 30	53.0		8.4	8.93	12.5	4.5	18.82	4.2	6.4			
- 20	23.43	ME CHARLES	7.9	5.69	9.9	4.4	10.23	3.6	6.0	al Large B.		
- 10	10.87		7.5	3.68	7.4	4.3	5.767	2.9	5.7	Mile Steel Day		
0	5.25	13.2	7.1	2.45	5.0	3.9	3.363	2.2	5.3			
10	2.635	10.9	6.7	1.68	2.7	3.6	2.024	1.7	5.0			
20	1.370	8.7	6.4	1.18	0.5	3.4	1.256	1.4	4.7	nois arms	H dightoral	
25	1.00	The state of the s	6.2	1.00	0.0	3.1	1.00	0.0	4.5	NO.	ΓE: For 1°C	
30	.7358	6.8	6.1	.854	1.4	3.0	.8013	1.3	4.4	Det	a Tables	2717
37	.4850	THE SECTION	5.9	.689		House to the	.5973	1.7	4.3	Rati	o Tables, se	е
40	.4075	4.9	5.8	.628	3.2	2.9	.5241	1.9	4.2	nag	es 223 to 22	7
50	.2322	3.2	5.5	.464	5.0	2.8	.3507	2.4	4.0	pag	00 220 10 22	1000
60	.1358	1.5	5.2	.350	6.7	2.7	.2400	2.5	3.7			
00		0.0	5.0	.267	8.2	2.6	.1677	2.6	3.5			
	.08146	1.4	4.8	.208	9.8	2.5	.1194	2.7	3.4			
70	.08146			.163	11.2	2.5	.08652	2.7	3.4			
70 80	.05000		1 46		11.2		.06370					
70 80 90	.05000 .03137	2.8	4.6		106		1 (10.3/1)	2.9	3.0	THE RESERVE THE PARTY OF THE PA		
70 80 90 100	.05000 .03137 .02009	2.8 4.1	4.4	.130	12.6	2.3			0.0			
70 80 90 100 110	.05000 .03137 .02009 .01311	2.8 4.1 5.2	4.4 4.2	.130 .105	12.6	2.3	.04761	3.0	2.8			
70 80 90 100 110 120	.05000 .03137 .02009 .01311 .008715	2.8 4.1 5.2 6.4	4.4 4.2 4.0	.130 .105 .085	12.6	2.3	.04761 .03610	3.0 3.1	2.72			
70 80 90 100 110 120 125	.05000 .03137 .02009 .01311 .008715 .007151	2.8 4.1 5.2 6.4 7.0	4.4 4.2 4.0 3.9	.130 .105 .085 .077	12.6	2.3	.04761 .03610 .03160	3.0 3.1 3.2	2.72 2.64			
70 80 90 100 110 120 125 130	.05000 .03137 .02009 .01311 .008715 .007151	2.8 4.1 5.2 6.4 7.0 7.6	4.4 4.2 4.0 3.9 3.8	.130 .105 .085 .077 .070	12.6	2.3	.04761 .03610 .03160 .02774	3.0 3.1 3.2 3.3	2.72 2.64 2.58			
70 80 90 100 110	.05000 .03137 .02009 .01311 .008715 .007151	2.8 4.1 5.2 6.4 7.0	4.4 4.2 4.0 3.9	.130 .105 .085 .077	12.6	2.3	.04761 .03610 .03160	3.0 3.1 3.2	2.72 2.64			

NTC Thermistors Curve Tracking and Point Matched



Curve Tracking Thermistors are "curve matched" to desired temperature tolerances over selected temperature ranges. They allow component standardization and can reduce cost associated with assembly because they are curve tracking to within the tolerance and temperature range specified without re-calibration. They are ideally suited for use in microcomputer measurement and control circuits. The temperature tolerance corresponds to a

resistance tolerance based on the temperature coefficient at each temperature point within the specified range. Standard temperature tolerance and ranges are listed below, along with the available styles and resistances.

To specify, add the appropriate suffix from the following table to the part number.

Example: 1M1002-B3 = Curve 1, 10 kilohm at 25°C, curve tracking to $\pm .5°C$ from 0° to 70°C.

	TEMP. F	RANGE	0°	C to + 7	0°C	- 20°C t	o + 50°C	0°0	C to + 10	0°C	+ 25	5°C to +	90°C	0°0	C to + 50)°C
	TEMP. TOI	LERANCE	±1°C	± .5°C	± .2°C	± 1°C	± .5°C	± 1°C	± .5°C	± .2°C	±1°C	± .5°C	± .2°C	± 1°C	± .5°C	± .2°C
CURVE	PART NUMB	ER SUFFIX	- A3	- B3	- C3	- A2	- B2	- A4	- B4	- C4	- A5	- B5	- C5	- A8	- B8	- C8
NUMBER	R ₂₅ (Ohms)*	MODELS		9.8		57.JH	è.5.	10	8	ente						08
	2252	M, T	x	x	X	X	x	X	x					x	x	×
	3000	C, T	×	x	x	X	X	X	X					X	x	X
1	5000	M, F, T	×	X	x	NAS 3		X	X		X	x	X	X	X	X
	10,000	M, F, T	X	X	X	122		X	X	X	X	x	X	X	X	X
	20,000	M, T	X	X	X	10.5		X	X		X	x	X	X	X	X
	30,000	М	X	х	Х	238		X	X		X	х	X	X	X	X
2	1000	М	A.O.T			х								Х	х	
	30,000	M, T	×	х	x	564t		×			×	х	x	X	x	x
4	50,000	M, T	X	X	X	3190.		X	6 - 1		X	X	X	X	X	X
	100,000	M, T	X	X	X	6380. 1810.		X			×	х	X	X	х	X
3.6	30,000	M, T	х	х	x	8340. 0180:		×			x	х	x	X	x	х
8	50,000	M, T	X	X	Х	1030		X			X	x	X	X	X	X
	100,000	M, T	X	X	X	3 62337		X	West 15 II		×	х	X	X	х	X
	10,000	M, T	×	х	х	ATAN.	1277				×	х	x	X	х	х
9	20,000	М	X	X	X	realis				0.000	X	X	X	X	х	X
	30,000	F	X	X	X	10.88	87				X	X	X	X	X	X

X = Available. Popular Values - contact factory for other values.

Point Matched Thermistors are available for applications which require a specific resistance value matched to a specific temperature point. (Example: $10,000 \text{ ohm} \pm 2\%$ at 80°C). They are useful for applications which require temperature monitoring

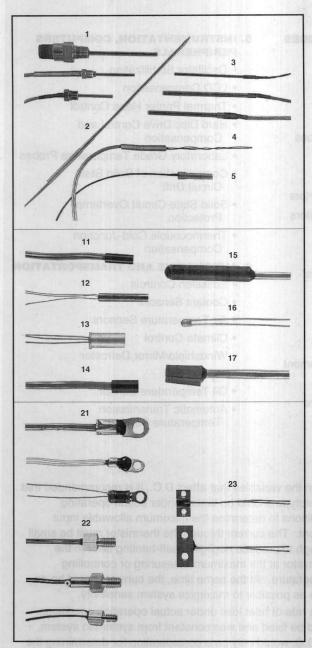
at a critical temperature point to control, measure or shut-down. Consult factory with requirements.

NOTE: All thermistors listed in this catalog are point matched thermistors at 25°C. (X Models at 70°C).

^{* =} Standard R25 Values (25°C resistance).

NTC Thermistor Assemblies





NOTE: A variety of wire styles is available from stock. Depending on the probe and application, the wire will vary. Consult the factory for this and other information.

HOW TO ORDER

- 1. Choose Style: Immersion probe.
- 2. Select Style Type: "1" = thread mount.
- 3. Select Thermistor: 1M1002-C3.
- 4. Indicate style, type and thermistor to factory for part numbers.

Standard and custom assemblies are available in a variety of configurations. The choice of assembly style is dependent on the application. The primary factors which determine the optimum configuration of a thermistor assembly are the operating environment, mounting, time response and minimum dissipation constant.

The two factors which do vary considerably with assembly design are time constant and dissipation constant. The time constant will typically be of greater duration in encapsulated thermistors. This is, of course, due to additional mass surrounding the thermistor element; therefore, extending the thermal transfer time. Dissipation constant will also be greater in assemblies. The additional housing mass serves well as a heat sink. Greater power is therefore required to induce self-heating.

Both time constant and dissipation constant will vary with the selected thermistor and housing. Heat transfer properties of the housing, thermistor location, mass and wire type determine these constants. It is recommended to evaluate or consult the factory in applications where T.C. and D.C. are critical.

ASSEMBLY STYLES

■ Immersion Probes

- 1. Thread Mounted: Features a stainless steel tube with a hermetically sealed threaded hex fitting. Available in 1/8", 3/16" and 1/4" outer diameter tubes with 1/8" or 1/4" NPT hex fittings. Ideal for pressured, closed systems.
- 2. Penetration Probe: 7" long x 1/8" outer diameter stainless steel tube. Pointed tip easily penetrates soft and semi-frozen materials. Also ideal for soil and ground measurements.
- 3. Tubular Stainless Steel: 1/8", 3/16" and 1/4" outer diameter tubes in variable lengths. Good for universal immersion applications. Adaptable to use with compression thread mounts to give designer variable immersion depths.
- Tubular Pyrex[®]: 6" long x 3/16" outer diameter glass tube. Excellent for lab use where a chemically inert probe is required.
- 5. Flexible Immersion: 1.5" long x .280" outer diameter aluminum housing. Flexible 105°C PVC tubing to protect wire and thermistor element from the liquid medium. Ideal assembly for intermittent immersion in hard to reach areas.

■ General Purpose Sensors

- 11. Delrin[®] Housing: 1/2" long x .170" outer diameter thermoplastic. Excellent for environmental controls and applications below 100°C.
- 12. Stainless Steel Rod: .875" x .156" outer diameter. Good for environmental chamber measurement where corrosive gasses exist.
- 13. Gold Anodized Flanged Sensor: .630" long x .275" outer diameter with a .298" flange diameter. An easy to mount press fitting.
- 14. ABS Housing: .476" long x .230" outer diameter. Black thermoplastic and configuration suits it well in air flow temperature measurements.
- **15. Polyester Housing:** 1.50" long x .280" outer diameter. Heavy thermoplastic case makes it ideal for applications requiring delayed time responses. Ideal for process controls in refrigeration and heating.
- 16. Epoxy Tip Probe: Durable epoxy encapsulation, small size, fast time response, versatility and low cost make this sensor universally accepted. Assembly size will vary with wire and thermistor choice.
- 17. Pipe Sensor: .625" long with a cut-out radius of .250" suits this nylon thermoplastic as an ideal pipe sensor. Extensive use is seen in environmental and water heating/cooling systems.

■ Surface Sensors

- 21. Ring Tongue Lugs: Surface mount with a #4, #6, #8 or #10 screw. Excellent for measurement and control of surfaces where fast time responses are necessary.
- 22. Heat Sink Sensors: Available in brass, aluminum or stainless steel with various threads. A durable and practical surface sensor, especially where shock and vibration are present.
- 23. Rectangular Block Sensors: Aluminum blocks for measurement and control of large surface areas. Easily mountable with #6 screws.

Refer to "How to Select an NTC Thermistor" for general design aids in choice of thermistor value, tolerance and R-T curve.

NTC Thermistors



TYPICAL APPLICATIONS

1. TELECOMMUNICATIONS APPLICATIONS

- Temperature Compensation of Crystal Oscillators (TCXO)
- Gain Stabilization
- Transistor Temperature Compensation
- Ambient Temperature Compensation

2. INDUSTRIAL APPLICATIONS

- Heat Pump Sensors
- Chiller Sensors
- Bearing Overtemp Protection
- · Photographic Processing
- Copy Machines
- Gas Analyzers
- PH Monitors
- Compressor Controls
- Differential Temperature Control
- Industrial Process Controls
- Crystal Ovens
- Refrigeration
- Fan Motor Speed Control
- Commercial Vending Machines

3. CONSUMER APPLIANCES

- Thermostats
- Refrigerators
- Air Conditioners
- Dishwashers
- Microwave Meat Probes
- Small Appliances
- Coffee Makers
- Electronic Thermometers
- Energy Efficient Monitors
- Solar Collectors
- Smoke Detectors
- Portable Refrigerators/ Food Warmers

4. MEDICAL

- Kidney Dialysis
- Blood Oxygenator
- Blood Analysis Equipment
- Respirators
- Blood Gases Monitors
- Infant Incubators

5. INSTRUMENTATION, COMPUTERS PERIPHERALS

- Oscillator Stabilization
- LCD Compensation
- Thermal Printer Head Control
- Hard Disc Drive Control and Compensation
- Laboratory Grade Temperature Probes
- Compensation of Solid State Circuit Drift
- Solid State Circuit Overtemp Protection
- Thermocouple Cold-Junction Compensation

6. AUTOMOTIVE AND TRANSPORTATION

- Emission Controls
- Coolant Sensors
- Air Temperature Sensors
- Climate Control
- Windshield/Mirror Defroster
- Altimeter
- Oil Temperature Sensor
- Automatic Transmission Temperature Sensor

HOW TO SELECT AN NTC THERMISTOR

1. Dissipation Constant (D.C.)

The dissipation constant is the amount of power (expressed in milliwatts) required to self-heat the thermistor suspended by its two inch leads in still air 1°C above its environment. The dissipation constant of NTC thermistor/NTC thermistor sensor assembly is typically defined as the ratio (at a specified ambient temperature) of the power dissipated in the thermistor to the resultant change in the temperature of the thermistor.

This constant (expressed as the power in milliwatts required to self-heat the thermistor 1°C above ambient temperature) increases slightly with increasing temperature. The lead length and type of lead, the type of encapsulating material (epoxy, durez, stainless steel probe, thermoplastic probe, etc.) the mounting of the NTC thermistor/assembly, the medium of the surrounding environment (flowing gas, still air, water, oil, etc.) and other factors generally determine the dissipation constant of an NTC thermistor/NTC thermistor sensor assembly.

Given the variables that affect D.C., it is recommended that a prototype should be tested under actual operating conditions to determine the maximum allowable input current. The current through the thermistor must be small enough to produce negligible self-heating error in the thermistor at the maximum measuring or controlling temperature. At the same time, the current should be as large as possible to maximize system sensitivity. If the rate of heat loss under actual operating conditions could be fixed and was constant from system to system, the D.C. would only be a consideration for determining the maximum power dissipated and an offset allowance could b

the D.C. would only be a consideration for determining the maximum power dissipated and an offset allowance could be made. For example, if the D.C. of a thermistor assembly had been determined as 3mW/°C in a stirred oil bath (the medium to be measured) and it was desired to measure the oil bath to an absolute temperature accuracy of \pm 0.1°C, the maximum power that should be developed in the thermistor by the measuring current is 0.15mW. This is to keep the self-heat factor to 50% or less of the measurement accuracy.

upper temperature. This is determined by using Ohm's Law $E \div I = R$ (E = volts, I = current, R = resistance). The D.C. is then calculated by dividing the power dissipated in the NTC thermistor by the temperature difference between the two measured temperatures. Power is calculated by using Ohm's Law, $P = E \times I$.

2. Time Constant (T.C.)

The time constant is the time in seconds required for the thermistor to change through 63.2% of the difference between its initial and final body temperatures, when subjected to a step change in temperature under zero-power conditions. Since the NTC thermistor's T.C. is determined by the same factors as D.C. (i.e., encapsulation, mounting, lead length, etc.), a prototype should be built if T.C. is important.

The time constant is determined by measuring the resistance of the thermistor at three temperature points, the middle point being 63.2% of the difference between the upper one and the lower one. A precision bridge is set for the middle temperature resistance with the bridge voltage supply set so as not to produce the self-heat error. An auxiliary bridge voltage is set for the higher temperature resistance. The thermistor is placed in the operating medium at the lower temperature and is connected to the auxiliary bridge. The auxiliary bridge is adjusted to balance the bridge, which in effect, will self-heat the thermistor to the upper temperature. The thermistor is then immediately switched to the precision bridge. The time required for the precision bridge to balance is the time constant of the NTC thermistor/NTC thermistor sensor assembly in the operating medium.

3. Selection of Resistance Value

Typically, NTC thermistors are specified and/or referenced to 25°C. However, it is equally important to consider the minimum and maximum resistance values at the extremes of the operating temperature range.

The minimum resistance at the maximum temperature point must not be too low to meet the input requirements of the measuring circuit. If the resistance is too low, errors due to contact resistance, line resistance and self-heating increase.

input current as determined by the dissipation constant and allowable self-heat error.

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4. R-T Curve Selection

At present, eleven R-T curves are available from Dale Electronics, Inc. Each material has a different R-T characteristic. Given the different resistivities of the different R-T materials and the desirability of maintaining uniformity in size, not all resistance values (R25) are available in all R-T curves.

Once the minimum resistance at the maximum temperature is determined, divide this resistance value by a given RT/R25 ratio from one of any of the R-T curves to determine an approximate R25 value. (NOTE: R-T ratio tables in 1°C increments are included on pages 223 to 227.) If the R25 value is not available in one R-T curve, select another until an appropriate R-T curve is determined. Then select a standard R25 value that is closest to the approximate value. Calculate the maximum resistance at the minimum temperature by multiplying the selected R25 by the given R-T/R25 ratio. If the selected R-T curve and R25 value meet the pre-determined minimum resistance, maximum resistance and sensitivity of the measurement system, then tolerance is the next consideration.

5. Tolerance

Most temperature measurement or control applications express their limitations or accuracy in temperature units (i.e. \pm 1.0°C). When designing a system, it is important to consider the overall measurement accuracy of all components. A \pm 1.0°C thermistor, coupled with a \pm 1.0°C system, will insure measurement accuracy to ± 2.0 °C. Thermistors may be specified with either a temperature tolerance or a resistance tolerance at either a single temperature point or over a temperature range. If the required temperature measurement accuracy is over a temperature range, it is more practical to specify a temperature tolerance in lieu of a resistance tolerance. This is because a resistance tolerance specification over a range will not necessarily guarantee that the required system accuracy will be met unless the non-linear NTC (negative temperature coefficient) is taken into consideration.

HOW TO SELECT AN NTC THERMISTOR

NTC is expressed in % resistance change per degree C. Since one NTC resistance change is approximately equivalent to a 1° temperature change, NTC is useful in specifying temperature tolerances.

NTC's are given on the Dale Specification Sheet in ten degree increments; however, the NTC may be calculated at any temperature point using a 1°C R-T table.

$$NTC = \left(\frac{1}{R} \cdot \frac{dR}{dT} \cdot 100\right)$$

Example: What is the NTC of 10,000 ohm (R25) of a Curve 1 thermistor at 44°C?

$$100 \left(\frac{1}{4543\Omega @ 44^{\circ}C} \times \frac{4368\Omega @ 45^{\circ}C - 4725\Omega @ 43^{\circ}C}{2} \right) = 3.9\%$$

To determine the resistance tolerance at any given temperature point, simply multiply the specified temperature tolerance by the NTC at the given temperature.

Example: What are the resistance tolerances at 0°C, 25°C and 70°C for a Curve 1 thermistor with a \pm 0.5°C temperature tolerance over the range of 0°C to 70°C? $R_0 = \pm 0.5^{\circ}C \text{ x - 5.1\%} = \pm 2.55\% \text{ resistance tolerance}$ $R_{25} = \pm 0.5^{\circ}C \text{ x - 4.4\%} = \pm 2.2\% \text{ resistance tolerance}$ $R_{70} = \pm 0.5^{\circ}C \text{ x - 3.4\%} = \pm 1.7\% \text{ resistance tolerance}$
It may now be clear why a single resistance tolerance over a temperature range may not be practical for a particular temperature measurement application.

If a single temperature point is the only design specification, NTC and Manufacturing Tolerances are useful in determining temperature tolerances at other temperature points. Manufacturing Tolerance is given on the Dale Specification Sheet in a \pm % resistance tolerance. Point-matched specifications must have the difference in deviation between the specified temperature point and any other temperature point of interest added to the resistance tolerance at the specified temperature.

Example: What are the resistance tolerances at 0°C and 50°C for a standard 1M1002?

 $R_0 = \pm \ 10\% \ + \pm \ 1.1\% = \pm \ 11.1\% \ resistance \ tolerance$ $R_{25} = \pm \ 10\% \ + \pm \ 0.0\% = \pm \ 10\% \ resistance \ tolerance$ $R_{50} = \pm \ 10\% \ + \pm \ 1.1\% = \pm \ 11.1\% \ resistance \ tolerance$

To determine the temperature tolerance at any temperature point, divide the resistance tolerance by the NTC at that point.

Example: What is the temperature tolerance at 0°C for a 1M1002?

 \pm 11.1% \div - 5.1% = \pm 2.2°C temperature tolerances

It should be noted that the Manufacturing Tolerances listed on the Dale Specification Sheet are all referenced at 25°C. If the thermistor is referenced at a temperature other than 25°C, then the total difference in deviation between the two points, if the 25°C is between them, is the sum of the maximum deviations listed at each point.

Example: What is the maximum resistance tolerance of a Curve 1 thermistor at 0°C if the specified tolerance is \pm 5% at 70°C?

(\pm 5% resistance tolerance at 70°C) + (MT \pm 1.8% at 70°C) + (MT \pm 1.1% at 0°C) = \pm 7.9% resistance tolerance at 0°C.

6. Tolerance Availability vs. R-T Curve

Not all temperature/resistance tolerances are available in all R-T Curves. If a temperature tolerance over an extended temperature range is required, then at present, Curves 1, 2, 4, 8 or 9 may be selected. All other curves may be specified to a resistance or temperature tolerance at a single temperature point. Curves 12 and 13 may only have $\pm\,5\%$ or $\pm\,10\%$ resistance tolerances specified. Contact the factory for further information.

7. Tolerance Availability vs. Configuration

Not all temperature/resistance tolerances are available in all configurations. Basically, Hybrids, uncoated NTC thermistors without leads and uncoated NTC thermistors with leads are only available in $\pm\,5\%$ or $\pm\,10\%$ point-matched resistance tolerances.

8. Thermistor resistance measurements must be made at precisely controlled temperature while applying essentially zero-power to assure measurement accuracy.

RESISTANCE-TEMPERATURE RELATIONSHIP

Many empirical equations have been developed over the years in an attempt to accurately describe the non-linear resistance-temperature dependence of NTC thermistors. An early equation called the "Beta" formula proved to be useful over narrow temperature ranges for broad tolerances. The Beta formula may be written using a single material dependent constant B as:

$$R(T) = R (To) \exp \left[B \left(\frac{1}{T} - \frac{1}{To} \right) \right]$$

where R (T) is the resistance at the temperature T in Kelvin and R (To) is a reference point at temperature To. The Beta formula requires a two-point calibration, but under the best of conditions is not accurate to \pm 1°C over the range of 0°C to 100°C and typically not to \pm 5°C over our published temperature ranges.

The best empirical expression published to date is the Steinhart-Hart equation written explicitly in temperature T as:

$$\frac{1}{T}$$
 = A + B (In R) + C (In R) ³

where In R is the natural logarithm of the resistance R at temperature T and the A, B and C's are derived coefficients from actual measurement. This form of the Steinhart-Hart equation requires a minimum of three calibration points to determine the derived coefficients. Typical accuracies would be less than \pm 0.15°C over the range of - 50°C to + 150°C.

If the temperature points selected from the R-T tables to calculate A, B, C lie within a 100°C range, the accuracy is better than $\pm\,0.01^{\circ}\text{C}$, assuming measurement accuracy to at least four significant figures and preferably five.

The Steinhart-Hart equation is an approximation. If a tighter tolerance than guaranteed is desired, then each thermistor must be individually calibrated.

CONVERSION TABLES NTC Thermistors





CURV	E 1 R/T	CONV	ERSION	1 TABL	E Rt/R2	5		CURV	E 2 R/1	CONV	ERSIO	N TABL	E Rt/R2	5	4 7 7 7 7
TEMP.	Rt / R25	TEMP. °C	Rt/ R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP. °C	Rt / R25	TEMP. °C	Rt / R25	TEMP. °C	Rt / R25
- 60	141.18	-7	4.708	46	.4201	99	.07000	- 55	53.40	- 3	3.222	49	.4225	101	.0921
- 59	130.76	- 6	4.464	47	.4041	100	.06798	- 54	50.10	- 2	3.079	50	.4086	102	.0898
-58	121.18	- 5	4.234	48	.3888	101	.06602	- 53	47.02	-1	2.944	51	.3953	103	.0875
-57	112.36	- 4	4.017	49	.3742	102	.06413	- 52	44.16	0	2.815	52	.3824	104	.0853
- 56	104.24	- 3	3.812	50	.3602	103	.06231	- 51	41.48	100.	2.692	53	.3700	105	.0832
- 55	96.77	- 2	3.620	51	.3468	104	.06054	- 50	38.99	2	2.576	54	.3581	106	.0811
- 54	89.87	- 1	3.438	52	.3340	105	.05884	- 49	36.66	3	2.465	55	.3467	107	.0792
- 53	83.52	0	3.266	53	.3217	106	.05719	- 48	34.48	4	2.360	56	.3356	108	.0772
- 52	77.65	201	3.104	54	.3099	107	.05559	- 47	32.45	5	2.260	. 57	.3250	109	.0753
- 51	72.24	2	2.951	55	.2987	108	.05404	- 46	30.55	6	2.164	58	.3147	110	.0735
- 50	67.23	3	2.806	56	.2878	109	.05255	- 45	28.77	7	2.074	59	.3049	111	.0717
- 49	62.61	4	2.669	57	.2775	110	.05110	- 44	27.11	8	1.987	60	.2954	112	.0700
- 48	58.33	5	2.540	58	.2675	111	.04970	- 43	25.55	9	1.905	61	.2862	113	.0683
- 47	54.38	6	2.418	59	.2580	112	.04835	- 42	24.09	10	1.826	62	.2774	114	.0667
- 46	50.71	7	2.302	60	.2489	113	.04704	- 41	22.73	11	1.751	63	.2689	115	.0651
- 45	47.32	8	2.192	61	.2401	114	.04577	- 40	21.45	12	1.680	64	.2607	116	.0636
- 44	44.18	9	2.089	62	.2317	115	.04454	- 39	20.25	13	1.612	65	.2528	117	.0621
- 43	41.26	10	1.990	63	.2236	116	.04335	- 38	19.13	14	1.547	66	.2451	118	.0607
- 42	38.56	11	1.897	64	.2158	117	.04219	- 37	18.07	15	1.485	67	.2378	119	.0593
- 41	36.05	12	1.809	65	.2084	118	.04108	- 36	17.08	16	1.426	68	.2306	120	.0579
- 40	33.72	13	1.726	66	.2012	119	.03999	- 35	16.15	17	1.370	69	.2238	121	.0566
- 39	31.55	14	1.647	67	.1944	120	.03894	- 34	15.28	18	1.316	70	.2172	122	.0553
- 38	29.54	15	1.571	68	.1878	121	.03793	- 33	14.46	19	1.264	71	.2108	123	.0540
- 37	27.67	16	1.500	69	.1814	122	.03694	- 32	13.68	20	1.215	72	.2046	124	.0528
- 36	25.93	17	1.432	70	.1753	123	.03598	- 31	12.96	21	1.168	73	.1986	125	.0516
- 35	24.31	18	1.368	71	.1695	124	.03506	- 30	12.27	22	1.123	74	.1929	126	.0504
- 34	22.80	19	1.307	72	.1638	125	.03416	- 29	11.63	23	1.080	75	.1873	127	.0493
- 33	21.39	20	1.249	73	.1584	126	.03329	- 28	11.03	24	1.039	76	.1820	128	.0482
- 32	20.08	21	1.194	74	.1532	127	.03244	- 27	10.46	25	1.000	77	.1768	129	.0471
- 31	18.86	22	1.142	75	.1482	128	.03162	- 26	9.918	26	.9624	78	.1717	130	.0461
- 30	17.72	23	1.092	76	.1433	129	.03083	- 25	9.411	27	.9265	79	.1669	131	.0451
- 29	16.65	24	1.045	77	.1387	130	.03005	- 24	8.934	28	.8921	80	.1622	132	.0441
- 28	15.66	25	1.000	78	.1342	131	.02930	- 23	8.483	29	.8591	81	.1577	133	.0431
- 27	14.73	26	.9572	79	.1299	132	.02858	- 22	8.058	30	.8276	82	.1533	134	.0422
- 26	13.86	27	.9165	80	.1258	133	.02787	- 21	7.657	31	.7973	83	.1490	135	.0413
- 25	13.05	28	.8777	81	.1218	134	.02718	- 20	7.278	32	.7684	84	.1449	136	.0404
- 24	12.29	29	.8408	82	.1179	135	.02652	- 19	6.920	33	.7406	85	.1410	137	.0395
- 23	11.58	30	.8056	83	.1142	136	.02587	- 18	6.582	34	.7140	86	.1371	138	.0387
- 22	10.92	31	.7721	84	.1106	137	.02524	- 17	6.263	35	.6885	87	.1334	139	.0379
- 21	10.30	32	.7402	85	.1072	138	.02464	- 16	5.960	36	.6641	88	.1298	140	.0371
- 20	9.713	33	.7098	86	.1039	139	.02404	- 15	5.675	37	.6406	89	.1263	141	.0363
- 19	9.166	34	.6808	87	.1007	140	.02347	- 14	5.404	38	.6181	90	.1229	142	.0355
- 18	8.654	35	.6531	88	.09759	141	.02291	- 13	5.148	39	.5965	91	.1197	143	.0348
- 17	8.173	36	.6267	89	.09461	142	.02236	- 12	4.906	40	.5758	92	.1165	144	.0341
- 16	7.722	37	.6015	90	.09174	143	.02184	-11	4.676	41	.5559	93	.1134	145	.0334
- 15	7.298	38	.5774	91	.08897	144	.02132	- 10	4.459	42	.5368	94	.1105	146	.0327
- 14	6.900	39	.5545	92	.08630	145	.02082	- 9	4.253	43	.5185	95	.1076	147	.0320
- 13	6.526	40	.5326	93	.08372	146	.02034	-8	4.058	44	.5008	96	.1048	148	.0314
- 12	6.175	41	.5116	94	.08123	147	.01987	-7	3.872	45	.4839	97	.1021	149	.0307
- 11	5.845	42	.4916	95	.07882	148	.01941	- 6	3.697	46	.4676	98	.0995	150	.0301
- 10	5.534	43	.4725	96	.07650	149	.01896	- 5	3.530	47	.4520	99	.0969	801	
- 9	5.242	44	.4543	97	.07426	150	.01853	- 4	3.372	48	.4370	100	.0945	231	
- 8	4.967	45	.4368	98	.07209			al meeting to the		CONTRACTOR OF THE PARTY OF THE					

NTC THERMISTOR CONVERSION TABLES

CORVI	= 3 K/I	CONV	ERSIO	N TABL	E Rt/R2	:5		CURV	E 4 R/1	CONV	ERSIO	NTABL	E Rt/R2	1	
TEMP. °C	Rt/ R25	TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt /
- 60	49.1	- 8	3.57	44	.532	96	.127	- 40	40.16	9	2.19	58	.2442	107	.044
- 59	46.3	-7	3.43	45	.515	97	.124	- 39	37.50	10	2.078	59	.2348	108	.043
- 58	43.6	- 6	3.29	46	.500	98	.121	- 38	35.04	11	1.976	60	.2259	109	.042
- 57	41.1	- 5	3.15	47	.484	99	.118	- 37	32.75	12	1.878	61	.2174	110	.040
- 56	38.8	- 4	3.02	48	.470	100	.115	- 36	30.62	13	1.787	62	.2092	111	.039
- 55	36.6	- 3	2.90	49	.455	101	.113	- 35	28.64	14	1.700	63	.2014	112	.038
- 54	34.5	-2	2.79	50	.442	102	.110	- 34	26.80	15	1.617	64	.1939	113	.037
- 53	32.6	-1	2.67	51	.428	103	.107	- 33	25.09	16	1.540	65	.1867	114	.036
- 52	30.8	0	2.57	52	.416	104	.105	- 32	23.50	17	1.466	66	.1798	115	.035
- 51	29.1	1	2.47	53	.403	105	.103	- 31	22.02	18	1.396	67	.1732	116	.034
- 50	27.5	2	2.37	54	.391	106	.100	- 30	20.64	19	1.330	68	.1669	117	.033
- 49	26.1	3	2.28	55	.380	107	.0980	- 29	19.35	20	1.267	69	.1608	118	.032
poto.	- 100	THE REAL PROPERTY.		201 1		00 00		1 400000	201	- GALETY		100000000000000000000000000000000000000		10100	
- 48	24.7	4	2.19	56	.369	108	.0957	- 28	18.16	21	1.208	70	.1550	119	.03
- 47	23.3	5	2.10	57	.358	109	.0937	- 27	17.04	22	1.152	71	.1495	120	.030
- 46	22.1	6	2.02	58	.348	110	.0917	- 26	15.99	23	1.099	72	.1441	121	.029
- 45	20.9	7	1.94	59	.338	111	.0893	- 25	15.02	24	1.048	73	.1390	122	.028
- 44	19.8	8	1.87	60	.328	112	.0873	- 24	14.11	25	1.000	74	.1341	123	.02
- 43	18.8	9	1.80	61	.319	113	.0857	- 23	13.26	26	.9545	75	.1293	124	.02
- 42	17.8	10	1.72	62	.310	114	.0837	- 22	12.47	27	.9113	76	.1248	125	.02
- 41	16.9	11	1.67	63	.301	115	.0820	- 21	11.73	28	.8702	77	.1204	126	.02
- 40	16.1	12	1.60	64	.293	116	.0800	- 20	11.03	29	.8313	78	.1163	127	.02
- 39	15.2	13	1.55	65	.285	117	.0783	- 19	10.39	30	.7942	79	.1122	128	.02
- 38	14.5	14	1.49	66	.277	118	.0767	- 18	9.78	31	.7590	80	.1084	129	.02
- 37	13.8	15	1.43	67	.269	119	.0750	- 17	9.21	32	.7256	81	.1047	130	.02
- 36	13.1	16	1.38	68	.262	120	.0733	- 16	8.68	33	.6938	82	.1011	131	.02
- 35	12.4	17	1.33	69	.255	121	.0720	- 15	8.18	34	.6636	83	.0977	132	.02
- 34	11.8	18	1.28	70	.248	122	.0703	- 14	7.71	35	.6348	84	.0944	133	.02
- 33	11.2	19	1.24	71	.241	123	.0687	- 13	7.28	36	.6074	85	.0912	134	.02
- 32	10.7	20	1.19	72	.234	124	.0673	- 12	6.87	37	.5814	86	.0882	135	.01
- 31	10.2	21	1.15	73	.228	125	.0660	- 11	6.48	38	.5566	87	.0852	136	.01
- 30	9.70	22	1.11	74	.222	126	.0647	- 10	6.12	39	.5330	88	.0824	137	.01
- 29	9.24	23	1.07	75	.216	127	.0633	- 9	5.78	40	.5105	89	.0797	138	.01
- 28	8.81	24	1.04	76	.211	128	.0620	- 8	5.46	41	.4891	90	.0771	139	.01
- 27	8.40	25	1.00	77	.205	129	.0607	- 7	5.16	42	.4686	91	.0746	140	.01
- 26	8.01	26	.966	78	.200	130	.0593	- 6	4.88	43	.4492	92	.0721	141	.01
- 25	7.64	27	.933	79	.195	131	.0583	- 5	4.62	44	.4306	93	.0698	142	.01
- 24	7.28	28	.901	80	.189	132	.0570	- 4	4.37	45	.4129	94	.0676	143	.01
- 23	6.95	29	.870	81	.185	133	.0560	- 3	4.13	46	.3961	95	.0654	144	.01
- 22	6.64	30	.841	82	.180	134	.0547	-2	3.91	47	.3800	96	.0633	145	.01
- 21	6.34	31	.813	83	.175	135	.0537	-1	3.71	48	.3646	97	.0613	146	.01
- 20	6.05	32	.786	84	.171	136	.0527	0	3.51	49	.3499	98	.0594	147	.01
- 19	5.79	33	.760	85	.167	137	.0517	1	3.33	50	.3359	99	.0575	148	.01
- 18	5.53	34	.735	86	.162	138	.0507	2	3.15	51	.3225	100	.0557	149	.01
- 17	5.29	35	.711	87	.158	139	.0497	3	2.99	52	.3098	101	.0540	150	.01
- 16	5.06	36	.688	88	.154	140	.0487	4	2.84	53	.2976	102	.0523	100	
- 15	4.84	37	.666	89	.151	4,459	- 61 -	5	2.69	54	.2859	103	.0507	1000	
- 14	4.63	38	.645	90	.147	4,253		6	2.55	55	.2748	104	.0491	c.e.a.	
- 13	4.43	39	.624	91	.143	880.4	8-19	7	2.43	56	.2641	105	.0476	1 8 8 F	
- 12	4.24	40	.604	92	.140	378.6 7		8	2.30	57	.2539	106	.0462	ETT A	
- 11	4.06	41	.585	93	.136	189.8	37	13010		92886		ETERN		日本田、美	
-10	3.89	42	.567	94	.133	058.8		02810.		Ocale.				9834	
	3.73	43	.549	95	.130	3.372		E2810		201400		PACE I		1000	

- 49	80.80	4	2.918	57	.2401	110	.03474	- 29	15.12	19	1.300	67	.1980	115	.04493
- 48	75.14	5	2.765	58	.2304	111	.03364	- 28	14.26	20	1.243	68	.1913	116	.04370
- 47	69.91	6	2.621	59	.2212	112	.03258	- 27	13.45	21	1.190	69	.1848	117	.04253
- 46	65.07	7	2.485	60	.2124	113	.03156	- 26	12.70	22	1.139	70	.1786	118	.04137
- 45	60.59	8	2.357	61	.2040	114	.03057	- 25	11.99	23	1.090	71	.1727	119	.04027
- 44	56.44	9	2.237	62	.1959	115	.02962	- 24	11.32	24	1.044	72	.1669	120	.03920
- 43	52.60	10	2.123	63	.1882	116	.02870	- 23	10.70	25	1.000	73	.1614	121	.03817
- 42	49.05	11	2.015	64	.1808	117	.02781	- 22	10.11	26	.9580	74	.1561	122	.03713
- 41	45.75	12	1.913	65	.1738	118	.02696	- 21	9.557	27	.9180	75	.1510	123	.03617
- 40	42.69	13	1.817	66	.1671	119	.02613	- 20	9.040	28	.8800	76	.1460	124	.03523
- 39	39.85	14	1.727	67	.1606	120	.02533	- 19	8.550	29	.8437	77	.1413	125	.03430
- 38	37.22	15	1.641	68	.1544	121	.02457	- 18	8.093	30	.8090	78	.1367	126	.03340
- 37	34.77	16	1.560	69	.1485	122	.02382	- 17	7.660	31	.7760	79	.1323	127	.03254
- 36	32.50	17	1.483	70	.1429	123	.02311	- 16	7.253	32	.7443	80	.1281	128	.03170
- 35	30.39	18	1.411	71	.1375	124	.02241	- 15	6.873	33	.7143	81	.1240	129	.03089
- 34	28.42	19	1.342	72	.1323	125	.02174	- 14	6.513	34	.6857	82	.1201	130	.03010
- 33	26.60	20	1.277	73	.1273	126	.02110	- 13	6.173	35	.6580	83	.1163	131	.02933
- 32	24.90	21	1.215	74	.1226	127	.02047	- 12	5.853	36	.6320	84	.1126	132	.02859
- 31	23.32	22	1.157	75	.1180	128	.01987	0-11	5.553	37	.6070	85	.1091	133	.02787
- 30	21.84	23	1.102	76	.1136	129	.01929	- 10	5.267	38	.5830	86	.1057	134	.02717
- 29	20.47	24	1.050	77	.1095	130	.01872	- 9	5.000	39	.5600	87	.1024	135	.02649
- 28	19.19	25	1.000	78	.1054	131	.01818	-8	4.747	40	.5383	88	.09930	136	.02583
- 27	18.00	26	.9530	79	.1016	132	.01765	-7	4.507	41	.5173	89	.09623	137	.02519
- 26	16.89	27	.9084	80	.09790	133	.01714	- 6	4.283	42	.4973	90	.09330	138	.02456
- 25	15.85	28	.8662	81	.09436	134	.01665	- 5	4.070	43	.4783	91	.09047	139	.02396
- 24	14.88	29	.8261	82	.09096	135	.01617	- 4	3.867	44	.4600	92	.08773	140	.02337
- 23	13.98	30	.7880	83	.08770	136	.01571	- 3	3.677	45	.4427	93	.08507	141	.02280
- 22	13.13	31	.7519	84	.08457	137	.01526	-2	3.497	46	.4257	94	.08253	142	.02225
- 21	12.34	32	.7176	85	.08156	138	.01483	16-10	3.327	47	.4097	95	.08007	143	.02171
- 20	11.61	33	.6850	86	.07868	139	.01442	0	3.166	48	.3943	96	.07770	144	.02119
- 19	10.92	34	.6541	87	.07591	140	.01401	1	3.014	49	.3797	97	.07540	145	.02068
- 18	10.27	35	.6247	88	.07325	141	.01362	2	2.870	50	.3657	98	.07317	146	.02018
- 17	9.668	36	.5967	89	.07069	142	.01324	3	2.733	51	.3523	99	.07103	147	.01970
- 16	9.103	37	.5702	90	.06823	143	.01287	4	2.604	52	.3393	100	.06897	148	.01924
- 15	8.573	38	.5449	91	.06587	144	.01252	5	2.481	53	.3269	101	.06697	149	.01878
- 14	8.077	39	.5209	92	.06360	145	.01218	6	2.365	54	.3150	102	.06500	150	.01834
- 13	7.613	40	.4981	93	.06142	146	.01184	7	2.255	55	.3036	103	.06313		
- 12	7.177	41	.4763	94	.05933	147	.01152			10773		Total Control			
- 11	6.769	42	.4556	95	.05731	148	.01121			gearo.		i skrist			
- 10	6.385	43	.4359	96	.05537	149	.01090			15870		e egene			
- 9	6.026	44	.4172	97	.05351	150	.01061	A STATE		07128		3555¢			
- 8	5.688	45	.3993	98	.05171							MELLE -			

NTC THERMISTOR CONVERSION TABLES

CURVE	9 R/T	CONV	ERSION	TABL	E Rt/R2	5	1271	CURV	E 12 R	T CON	VERSIC	N TAE	LE Rt/R	25	
TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP. °C	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP. °C	Rt / R25	TEMP. °C	Rt/ R25
- 50	44.13	2	2.689	54	.3385	106	.06936	- 60	265.0	-7	6.126	46	.3516	99	.03762
- 49	41.45	3	2.569	55	.3270	107	.06753	- 59	244.0	- 6	5.763	47	.3354	100	.03624
- 48	38.94	4	2.455	56	.3160	108	.06575	- 58	225.0	- 5	5.423	48	.3199	101	.03492
- 47	36.60	5	2.346	57	.3054	109	.06403	- 57	207.0	- 4	5.104	49	.3053	102	.03364
- 46	34.41	6	2.243	58	.2952	110	.06235	- 56	191.0	- 3	4.806	50	.2914	103	.03242
- 45	32.37	7	2.145	59	.2854	111	.06073	- 55	176.4	- 2	4.526	51	.2782	104	.03125
- 44	30.46	8	2.052	60	.2760	112	.05916	- 54	162.9	1245	4.264	52	.2656	105	.03013
- 43	28.67	9	1.963	61	.2669	113	.05764	- 53	150.5	0	4.018	53	.2537	106	.02905
- 42	27.00	10	1.879	62	.2582	114	.05616	- 52	139.1	2115	3.788	54	.2423	107	.02801
- 41	25.44	\$11	1.798	63	.2497	115	.05473	- 51	128.6	2	3.572	55	.2316	108	.02702
- 40	23.98	12	1.722	64	.2417	116	.05334	- 50	119.0	3	3.369	56	.2213	109	.02606
- 39	22.60	13	1.649	65	.2339	117	.05199	- 49	110.1	4	3.179	57	.2115	110	.02514
															,
- 38	21.32	14	1.579	66	.2264	118	.05068	- 48	102.0	5	3.000	58	.2022	111	.02426
- 37	20.11	15	1.513	67	.2191	119	.04941	- 47	94.46	6	2.833	59	.1934	112	.02341
- 36	18.98	16	1.450	68	.2122	120	.04818	- 46	87.54	7	2.675	60	.1849	113	.02259
- 35 - 34	17.92 16.93	17 18	1.390	69 70	.2055	121 122	.04698	- 45	81.17	8 9	2.527	61	.1769	114	.02181
- 33	16.00	19	1.279	71	.1928	123	.04562	- 44	75.29 69.87	10	2.387 2.256	62 63	.1693	115	.02106
- 32	15.12	20	1.226	72	.1868	124	.04359	- 43	64.87	11	2.236	64	.1551	116	.02033
- 31	14.30	21	1.177	73	.1810	125	.04359	- 42	60.24	12	2.133				.01897
- 30	13.52	22	1.129	74	.1754	126	.04253	- 40	55.98	13	1.908	65 66	.1485	118	
- 29	12.79	23	1.084	75	.1700	127	.04049	- 39	52.03	14	1.806	67	.1422		.01832
- 28	12.11	24	1.041	76	.1648	128	.03951	- 38	48.39	15	1.709	68	.1304	120 121	.01770
- 27	11.46	25	1.000	77	.1598	129	.03856	- 37	45.01	16	1.618	69	.1250	122	.01653
- 26	10.86	26	.9605	78	.1549	130	.03764	- 36	41.89	17	1.532	70	.1198	123	.01598
2 Man	1 1 1 2 1	11022												100 No.	
- 25	10.29	27	.9227	79	.1503	131	.03674	- 35	39.00	18	1.451	71	.1148	124	.01544
- 24	9.749	28	.8867	80	.1458	132	.03587	- 34	36.33	19	1.375	72	.1100	125	.01493
- 23	9.243	29	.8523	81	.1414	133	.03503	- 33	33.85	20	1.303	73	.1055	126	.01444
- 22	8.766	30	.8194	82	.1372	134	.03420	- 32	31.55	21	1.235	74	.1012	127	.01396
- 21	8.316	31	.7880	83	.1332	135	.03340	- 31	29.42	22	1.171	75	.09706	128	.01351
- 20	7.891	32	.7579	84	.1293	136	.03263	- 30	27.45	23	1.111	76	.09311	129	.01306
- 19	7.491	33	.7291	85	.1255	137	.03187	- 29	25.61	24	1.054	77	.08935	130	.01264
- 18	7.113	34	.7016	86	.1218	138	.03113	- 28	23.91	25	1.000	78	.08575	131	.01223
- 17	6.757	35	.6752	87	.1183	139	.03042	- 27	22.33	26	.9492	79	.08231	132	.01183
- 16	6.420	36	.6500	88	.1149	140	.02972	- 26	20.86	27	.9011	80	.07902	133	.01145
- 15	6.102	37	.6258	89	.1116	141	.02904	- 25	19.50	28	.8558	81	.07588	134	.01109
- 14	5.801	38	.6026	90	.1084	142	.02838	- 24	18.23	29	.8129	82	.07287	135	.01073
- 13	5.517	39	.5805	91	.1053	143	.02774	- 23	17.05	30	.7723	83	.07000	136	.01039
- 12	5.248	40	.5592	92	.1023	144	.02712	- 22	15.95	31	.7339	84	.06725	137	.01006
- 11	4.994	41	.5389	93	.09942	145	.02651	- 21	14.93	32	.6977	85	.06462	138	.00975
- 10	4.754	42	.5193	94	.09663	146	.02592	- 20	13.98	33	.6633	86	.06210	139	.00944
- 9	4.527	43	.5006	95	.09393	147	.02534	- 19	13.09	34	.6308	87	.05969	140	.00915
- 8	4.311	44	.4827	96	.09132	148	.02478	- 18	12.27	35	.6001	88	.05739	141	.00886
-7	4.107	45	.4655	97	.08879	149	.02423	- 17	11.50	36	.5710	89	.05518	142	.00859
- 6	3.914	46	.4489	98	.08634	150	.02370	- 16	10.78	37	.5434	90	.05307	143	.00832
- 5	3.731	47	.4331	99	.08397			- 15	10.11	38	.5173	91	.05105	144	.00806
- 4	3.557	48	.4179	100	.08168			- 14	9.486	39	.4925	92	.04911	145	.00782
- 3	3.393	49	.4033	101	.07946			- 13	8.903	40	.4690	93	.04725	146	.00758
- 2	3.237	50	.3893	102	.07731			- 12	8.359	41	.4468	94	.04547	147	.00735
- 1	3.089	51	.3758	103	.07523			- 11	7.850	42	.4257	95	.04377	148	.00712
0	2.949	52	.3629	104	.07321			- 10	7.375	43	.4057	96	.04213	149	.00691
1	2.815	53	.3504	105	.07126			- 9	6.930	44	.3867	97	.04057	150	.00670
								- 8	6.515	45	.3687	98	.03906	151	.00650

NTC THERMISTOR CONVERSION TABLES

CUR	VE 13	R/T	CON	VERS	ION T	TABL	E Rt/F	25										444)			
TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP. °C	. Rt / R25	TEMP. °C	Rt / R25	TEMF °C	P. Rt/ R25										
- 60	824.0	- 40	125.0	- 20	23.43	0	5.250	20	1.370	40	.4075	60	.1358	80	.05000		.02009		008715	2 / 65 / 51 / 62	.004048
- 59	745.0	- 39	114.0	- 19	21.65	1	4.892	21	1.285	41	.3847	61	.1289	81	.04768	100000000000000000000000000000000000000	.01923		008374	C 1972 N	.003902
- 58	675.0	- 38	105.0	- 18	20.02	2	4.560	22	1.207	42	.3633	62	.1224	82	.04548	THE THE STATE OF T	.01842		008048	1 10 2 10 10	.003762
- 57	612.0	- 37	96.0	- 17	18.52	3	4.253	23	1.133	43	.3432	63	.1162	83	.04338		.01764	100000000000000000000000000000000000000	007736	100000000000000000000000000000000000000	.003628
- 56	554.0	- 36	88.0	- 16	17.14	4	3.967	24	1.064	44	.3243	64	.1104	84	.04139	104	.01690		007437	21/20/20/20	.003499
- 55	503.0	- 35	81.0	- 15	15.87	5	3.702	25	1.000	45	.3065	65	.1049	85	.03950		.01619	10000	007151	0.000	.003375
- 54	457.0	- 34	74.0	- 14	14.70	6	3.456	26	.9399	46	.2898	66	.09966	86	.03771	106	.01552	STATE POLICE	006877	10.00	.003256
- 53	415.0	- 33	68.0	- 13	13.62	7	3.228	27	.8837	47	.2741	67	.09473	87	.03600	107	.01487	127 .	006615	147	.003141
- 52	377.0	- 32	63.0	- 12	12.63	8	3.016	28	.8311	48	.2592	68	.09006	88	.03438	108	.01426	128 .	006364	148	.003031
- 51	343.0	- 31	57.0	- 11	11.71	9	2.818	29	.7819	49	.2453	69	.08564	89	.03284	109	.01367	129 .	006123	149	.002925
- 50	312.0	- 30	53.0	- 10	10.87	10	2.635	30	.7358	50	.2322	70	.08146	90	.03137	110	.01311	130 .	005892	150	.002824
- 49	284.0	- 29	49.0	- 9	10.08	11	2.464	31	.6927	51	.2198	71	.07750	91	.02998	111	.01258	131 .	005671	10	
- 48	259.0	- 28	45.0	- 8	9.364	12	2.305	32	.6522	52	.2081	72	.07375	92	.02865	112	.01207	132 .	005459	11110	
- 47	236.0	- 27	41.0	-7	8.699	13	2.158	33	.6144	53	.1971	73	.07020	93	.02739	113	.01158	133 .	005256		
- 46	215.0	- 26	38.0	- 6	8.084	14	2.020	34	.5789	54	.1868	74	.06683	94	.02619	114	.01111	134 .	005061		
- 45	196.0	- 25	35.0	- 5	7.515	15	1.892	35	.5456	55	.1770	75	.06364	95	.02504	115	.01067	135 .	004874		
- 44	179.0	- 24	32.0	- 4	6.990	16	1.772	36	.5143	56	.1678	76	.06062	96	.02395	116	.01024	136 .	004695	183	
- 43	163.0	- 23	30.0	- 3	6.503	17	1.661	37	.4850	57	.1591	77	.05775	97	.02291	117	.009833	137 .	004523		
- 42	149.0	- 22	27.0	-2	6.053	18	1.557	38	.4575	58	.1509	78	.05503		.02193		.009444	138 .	004358		
- 41	137.0	- 21	25.0	-1	5.636	19	1.460		.4317	59	.1431	79	.05245		.02098		.009072	139 .	004200		

CUR	VE 14	4 R/T	CON	VERS	ION	TABL	E Rt/I	325													
TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25
- 60	43.0	- 40	14.4	- 20	5.69	0	2.45	20	1.18	40	.628	60	.350	80	.208	100	.130	120	.085	140	.058
- 59	40.4	- 39	13.7	- 19	5.43	1	2.36	21	1.14	41	.608	61	.342	81	.203	101	.127	121	.084	141	.057
- 58	38.0	- 38	13.1	- 18	5.20	2	2.27	22	1.11	42	.589	62	.332	82	.198	102	.124	122	.082	142	.056
- 57	35.8	- 37	12.5	- 17	4.98	3	2.18	23	1.07	43	.571	63	.323	83	.193	103	.122	123	.080	143	.055
- 56	33.8	- 36	11.8	- 16	4.75	4	2.10	24	1.03	44	.554	64	.313	84	.188	104	.119	124	.079	144	.054
- 55	31.9	- 35	11.3	- 15	4.56	5	2.02	25	1.00	45	.537	65	.305	85	.183	105	.117	125	.077	145	.053
- 54	30.2	- 34	10.8	- 14	4.37	6	1.95	26	.970	46	.522	66	.297	86	.179	106	.114	126	.076	146	.052
- 53	28.6	- 33	10.3	- 13	4.18	7	1.88	27	.939	47	.507	67	.289	87	.175	107	.112	127	.074	147	.051
- 52	27.1	- 32	9.79	- 12	4.01	8	1.81	28	.910	48	.492	68	.282	88	.171	108	.109	128	.073	148	.050
- 51	25.7	- 31	9.32	- 11	3.84	9	1.74	29	.881	49	.477	69	.274	89	.167	109	.107	129	.071	149	.049
- 50	24.3	- 30	8.93	- 10	3.68	10	1.68	30	.854	50	.464	70	.267	90	.163	110	.105	130	.070	150	.048
- 49	23.0	- 29	8.51	- 9	3.52	11	1.62	31	.828	51	.452	71	.261	91	.159	111	.103	131	.069		
- 48	21.8	- 28	8.12	- 8	3.39	12	1.57	32	.802	52	.438	72	.254	92	.156	112	.101	132	.067		
- 47	20.7	- 27	7.78	-7	3.25	13	1.52	33	.779	53	.426	73	.248	93	.152	113	.098	133	.066		
- 46	19.6	- 26	7.41	- 6	3.12	14	1.47	34	.756	54	.414	74	.242	94	.148	114	.096	134	.065		
- 45	18.6	- 25	7.10	-5	2.99	15	1.42	35	.732	55	.403	75	.236	95	.145	115	.094	135	.064		
- 44	17.6	- 24	6.80	- 4	2.87	16	1.37	36	.710	56	.393	76	.229	96	.142	116	.092	136	.062		
- 43	16.7	- 23	6.49	- 3	2.76	17	1.32	37	.689	57	.382	77	.224	97	:139	117	.091	137	.061		
- 42	15.9	- 22	6.21	-2	2.65	18	1.27	38	.668	58	.372	78	.218	98	.136	118	.089	138	.060	1 75 10	
- 41	15.1	- 21	5.93	-1	2.55	19	1.22	39	.647	59	.361	79	.213	99	.133	119	.087	139	.059		

CUR	VE 17	R/T	CON	VERS	SION .	TABL	E Rt/F	125													
TEMP.	Rt / R25	TEMP.	Rt/ R25	TEMP.	Rt / R25	TEMP °C	. Rt / R25														
- 50	72.50	- 31	20.24	- 12	6.519	7	2.369	26	.9603	45	.4276	64	.2081	83	.1086	102	.06021	121	.03520	140	.02158
- 49	68.17	- 30	18.82	- 11	6.143	8	2.254	27	.9205	46	.4122	65	.2001	84	.1050	103	.05846	122	.03430	141	.02109
- 48	63.84	- 29	17.82	- 10	5.767	9	2.139	28	.8808	47	.3968	66	.1936	85	.1014	104	.05672	123	.03340	142	.02060
- 47	59.50	- 28	16.81	-9	5.491	10	2.024	29	.8410	48	.3815	67	.1871	86	.09842	105	.05497	124	.03250	143	.02010
- 46	55.17	- 27	15.81	-8	5.215	11	1.937	30	.8013	49	.3661	68	.1807	87	.09545	106	.05350	125	.03160	144	.01961
- 45	50.84	- 26	14.80	- 7	4.940	12	1.850	31	.7703	50	.3507	69	.1742	88	.09247	107	.05203	126	.03083	145	.01912
- 44	47.89	- 25	13.80	- 6	4.664	13	1.763	32	.7392	51	.3384	70	.1677	89	.08950	108	.05055	127	.03006	146	.01869
- 43	44.94	- 24	13.09	- 5	4.388	14	1.676	33	.7082	52	.3261	71	.1624	90	.08652	109	.04908	128	.02929	147	.01826
- 42	41.99	- 23	12.37	- 4	4.183	15	1.589	34	.6771	53	.3138	72	.1571	91	.08404	110	.04761	129	.02851	148	.01784
- 41	39.04	- 22	11.66	- 3	3.978	16	1.522	35	.6461	54	.3017	73	.1518	92	.08155	111	.04637	130	.02774	149	.01741
- 40	36.09	- 21	10.94	-2	3.773	17	1.456	36	.6217	55	.2894	74	.1465	93	.07907	112	.04512	131	.02708	150	.01698
- 39	34.06	- 20	10.23	- 1	3.568	18	1.389	37	.5973	56	.2794	75	.1412	94	.07658	113	.04388	132	.02642		
- 38	32.02	- 19	9.713	0	3.363	19	1.323	38	.5729	57	.2696	76	.1368	95	.07410	114	.04263	133	.02575		
- 37	29.99	- 18	9.196	1	3.210	20	1.256	39	.5484	58	.2598	77	.1325	96	.07202	115	.04139	134	.02509	1111	
- 36	27.95	- 17	8.680	2	3.057	21	1.205	40	.5241	59	.2499	78	.1281	97	.06994	116	.04033	135	.02443	-2	
- 35	25.92	- 16	8.163	3	2.905	22	1.154	41	.5048	60	.2400	79	.1238	98	.06786	117	.03297	136	.02386		
- 34	24.50	- 15	7.646	4	2.752	23	1.102	42	.4855	61	.2320	80	.1194	99	.06578	118	.03822	137	.02329	POR DE	
- 33	23.08	- 14	7.270	5	2.599	24	1.051	43	.4662	62	.2240	81	.1158	100	.06370	119	.03716	138	.02272		
- 32	21.66	- 13	6.894	6	2.484	25	1.000	44	.4469	63	.2161	82	.1122	101	.06195	120	.03610	139	.02215		

PACKAGI	NG [Numbers in bracket	ets indicate millimeters]
CODE	TYPE	DESCRIPTION
PO6	Bulk	Coated, leaded thermistors in a 4" x 6" [101.60 x 152.40] antistatic plastic bag.
P20	Bulk	Disc style thermistors in a 4" x 6" [101.60 x 152.40] or 6.5" x 10" [165.10 x 254] antistatic plastic bag.
R58	Tape and Reel	Chip style thermistors in 8mm embossed plastic tape.
R85	Tape and Reel	Chip style thermistors in 12mm embossed plastic tape.
TO6	Tray	Chip style thermistors in molded waffle style trays.

Ceramic Power Capacitors



MODEL	CAPACITANCE RANGE (pF)	TOLERANCES (%)	RATED VOLTAGE (kVp)	RATED POWER (kVA)	RATED CURRENT (Arms)
WATER COOLE	D POWER CA	APACITORS		Edular Marie and	
TWXF95 x 162	100-2500	20-10	14	10001500	150
TWXF95 x 187	1000	20-10	14	1500	150
TWXF95 x 220	5000	20-10	12	1275	150
TWXF110 x 250	5000	20-10	14	2000	200
TWXF135 x 218	4000	20-10	16	2500	250
TWXF135 x 250	5000	20-10	16	2830	250
TWXF135 x 272	6000	20-10	16	2830	250
TWXF135 x 285	5000	20-10	20	3000	250
TWXF165 x 270	7600	20-10	16	3000	300
TWXF165 x 420	10000	20-10	18	2500	250
PLATE CAPAC	ITORS WITH	SMALL RIM			
Art. agr Eval ag v					
FP .20		14. 64 186.			
	4.7.0000	0.5 pF		0.00	5 00
to	4.7-6000	to 20%	28	360	520
FP .200		2078			
96 142 176 0					
000 This est 1 TE .					
PLATE CAPAC	ITORS WITH	CONTOURED	RIM		
P.20 to P.200	5.6-10000	0.5 pF to 20%	515	5140	5100
FEED-THROUG	H CAPACITO	60 82 4848. 40: 1: 98 1898.	BE BENTON BY	019.4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
D. 16 x 30					
to	15-2500	20-10-5	320	1.560	550

High Voltage Applications for ceramic power capacitors include: RF generators for induction heating and dielectric heating •
HF transmitters • RF suppression (feed-throughs) • X-Ray equipment • Electrostatic powder spraying • Special design capabilities available.

	to R. 45 x 120	3-2500	to 20%	211	0.560	450	
Hapt of Hat Choice	POT CAPACI	TORS WITH C	ONTOURED R	RIM			
888	T. 20 x 30						
	to	10-4000	20-10-5	615	2.550	615	
	T. 85 x 120						
	BARREL CAF	PACITORS				Alcanica Transitional	
*	TO. 16 x 10		0.5 pF				
\$	to	1.5-100	to 20%	5-9	0.82.5	5-10	
	TO. 25 x 16						

High Voltage Ceramic Capacitors



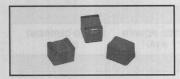
HIGH VOLTAGE HPA/HPD 350-5000 20 20 — 6 HPB/HPC 350-5000 20 20 — 6 HR 750-1500 20 2.8 — — 2000-5000 +50-20		MODEL	CAPACITANCE RANGE (pF)	TOLERANCES (%)	RATED VOLTAGE (kV)	RATED POWER (kVA)	RATED CURR (Arms)	ENT
HPA/HPD 350-5000 20 20 — 6 HPB/HPC 350-5000 20 20 — 6 HR 750-1500 20 2.8 — —	820.	HIGH VOL	TAGE					
HPB/HPC 350-5000 20 20 — 6 HR 750-1500 20 2.8 — —	(0)							
HR 750-1500 20 2.8 — —	0	HPA/HPD	350-5000	20	20	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6	
	TO JAMES	HPB/HPC	350-5000	20	20		6	
2000-5000 +50-20		HR	750-1500	20	2.8		_	
			2000-5000	+50-20				

MODEL IMC-1210 Inductors

Surface Mount, Molded

DCR





STANDARD ELECTRICAL SPECIFICATIONS

TEST FREQ.

FEATURES

SELF-

RESONANT

- Molded construction provides superior strength and moisture resistance
- Tape and reel packaging for automatic handling, 2000/reel, EIA 481

RATED

- Printed marking
- Compatible with vapor phase and infra-red reflow soldering

ELECTRICAL SPECIFICATIONS

Inductance Range: .01µH to 100µH.

Inductance Tolerance: \pm 20% for .01 μ H to .82 μ H. \pm 10% for 1.0 μ H to 100 μ H standard. Special tolerances available.

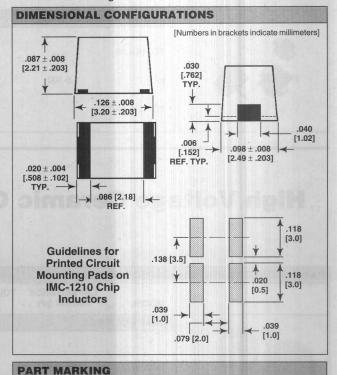
Temperature Range: - 40°C to + 105°C.

Coilform Material: Non-magnetic for .01 μ H to .10 μ H. Powdered Iron for .12 μ H to 100 μ H.

TEST EQUIPMENT

- H/P 4342A Q meter with Dale® test fixture or equivalent.
- H/P 4191A RF Impedance Analyzer (for SRF measurements).
- · Wheatstone Bridge.

IND. (μH)	TOL.	Q MIN.	L & Q (MHz)	FREQ. MIN. (MHz)	MAX. (Ohms)	CURRENT (mA)
.010	±20%	30	50.0	1000.0	.13	450
.012	±20%	30	50.0	1000.0	.14	450
.015	±20%	30	50.0	1000.0	.16	450
.018	±20%	30	50.0	1000.0	.18	450
.022	±20%	30	50.0	1000.0	.20	450
.027	±20%	30	50.0	1000.0	.22	450
.033	±20%	30	50.0	1000.0	.24	450
.039	±20%	30	50.0	1000.0	.27	450
.047	±20%	30	50.0	1000.0	.30	450
.056	±20%	30	50.0	1000.0	.33	450
.068	±20%	30	50.0	1000.0	.36	450
.082	±20%	30	50.0	900.0	.40	450
.100	±20%	30	50.0	700.0	.44	450
.12	±20%	30	25.2	500.0	.22	450
.15	±20%	30	25.2	450.0	.25	450
.18	±20%	30	25.2	400.0	.28	450
.22	±20%	30	25.2	350.0	.32	450
.27	±20%	30	25.2	320.0	.36	450
.33	±20%	30	25.2	300.0	.40	450
.39	±20%	30	25.2	250.0	.45	450
.47	±20%	30	25.2	220.0	.50	450
.56	±20%	30	25.2	180.0	.55	450
.68	±20%	30	25.2	160.0	.60	450
.82	±20%	30	25.2	140.0	.67	450
1.0	±10%	30	7.96	120.0	.70	400
1.2	±10%	30	7.96	100.0	.75	390
1.5	±10%	30	7.96	85.0	.85	370
1.8	±10%	30	7.96	80.0	.90	350
2.2	±10%	30	7.96	75.0	1.0	320
2.7	±10%	30	7.96	70.0	1.1	290
3.3	±10%	30	7.96	60.0	1.2	260
3.9	±10%	30	7.96	55.0	1.3	250
4.7	±10%	30	7.96	50.0	1.5	220
5.6	±10%	30	7.96	45.0	1.6	200
6.8	±10%	30	7.96	40.0	1.8	180
8.2	±10%	30	7.96	38.0	2.0	170
10.0	±10%	30	2.52	33.0	2.1	150
12.0	±10%	30	2.52	30.0	2.5	140
15.0	±10%	30	2.52	21.0	2.8	130
18.0	±10%	30	2.52	20.0	3.7	120 110
22.0	±10%					
27.0 33.0	± 10% ± 10%	30	2.52	18.0 16.0	5.0 6.0	80 70
39.0	±10% ±10%	30	2.52	15.0	7.0	65
47.0			2.52	14.0	9.0	60
56.0	± 10% ± 10%	30	2.52	12.0	10.0	55
68.0	±10% ±10%	30	2.52	11.0	11.0	50
82.0	±10%	30	2.52	10.0	12.0	45
100.0	±10%	20	.796	9.0	14.0	40
			., 00	0.0	17.	



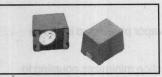
0021108	— Inductance value	
HOW TO ORDER		
IMC-1210	10μΗ	± 10%
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE

- Dale

MODEL IMC-1812 Inductors

Surface Mount, Molded





STANDARD ELECTRICAL SPECIFICATIONS

FEATURES

- Molded construction provides superior strength and moisture resistance
- Tape and reel packaging for automatic handling, 2000/reel, EIA 481
- Printed marking
- Compatible with vapor phase and infra-red reflow soldering

ELECTRICAL SPECIFICATIONS

Inductance Range: .01µH to 1000µH.

Inductance Tolerance: ± 20% for .01µH to .39µH.

 \pm 10% for .47 μ H to 1000 μ H standard.

 \pm 10%, \pm 5%, \pm 3% available.

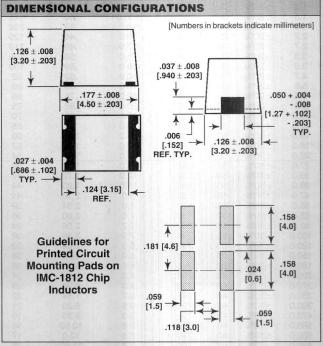
Temperature Range: - 40°C to + 105°C.

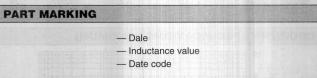
Coilform Material: Ceramic for .01μH to .82μH. Powdered Iron for 1.0μH to 120μH. Ferrite for 150μH to 1000μH.

TEST EQUIPMENT

- H/P 4342A Q meter with Dale® test fixture or equivalent.
- H/P 4191A RF Impedance Analyzer (for SRF measurements).
- Wheatstone Bridge.

에 보고 아무슨 아무슨 이렇게 되었다. 그는 그는 것이 되었다면 하는 사람들이 되었다면 하는 것이 없는 것이 없는 것이 없는데 없어서 가장 없었다.	MAX. Ohms)	DC CURRENT (mA)
.010 ±20% 50 50.0 1000.0	.20	450
.012 ±20% 50 50.0 1000.0	.20	450
.018 ±20% 50 50.0 1000.0	.20	450
.022 ±20% 50 50.0 1000.0	.20	450
.027 ±20% 50 50.0 1000.0	.20	450
.033 ±20% 50 50.0 1000.0	.30	450
.039 ±20% 50 50.0 1000.0	.30	450
.047 ±20% 50 50.0 1000.0	.30	450
.056 ±20% 40 50.0 900.0	.35	450
.068 ±20% 40 50.0 800.0	.35	450
.082 ±20% 40 50.0 700.0	.40	450
.10 ±20% 30 25.2 650.0	.32	450
.12 ±20% 30 25.2 600.0	.30	450
.15 ±20% 30 25.2 500.0	.30	450
.18 ±20% 30 25.2 400.0	.35	450
.22 ±20% 30 25.2 350.0	.40	450
.27 ±20% 30 25.2 300.0	.45	450
.33 ±20% 30 25.2 250.0	.55	430
.39 ±20% 30 25.2 220.0	.70	380
.47 ±10% 30 25.2 190.0 .56 ±10% 30 25.2 170.0	.80 1.20	355 285
.56 ±10% 30 25.2 170.0 .68 ±10% 30 25.2 150.0	1.40	270
.82 ±10% 30 25.2 130.0	1.60	250
1.0 ±10% 50 7.96 100.0	.50	450
1.2 ±10% 50 7.96 80.0	.55	430
1.5 ±10% 50 7.96 70.0	.60	410
1.8 ±10% 50 7.96 60.0	.65	390
2.2 ±10% 50 7.96 55.0	.70	380
2.7 ±10% 50 7.96 50.0	.75	370
3.3 ±10% 50 7.96 45.0	.80	355
3.9 ± 10% 50 7.96 40.0	.90	330
4.7 ±10% 50 7.96 35.0	1.00	315
5.6 ±10% 50 7.96 33.0	1.10	300
6.8 ±10% 50 7.96 27.0	1.20	285
8.2 ±10% 50 7.96 25.0	1.40	270
10.0 ±10% 50 2.52 20.0	1.60	250
12.0 ±10% 50 2.52 18.0	2.00	225
15.0 ±10% 50 2.52 17.0	2.50	200
18.0 ±10% 50 2.52 15.0	2.80	190
22.0 ±10% 50 2.52 13.0	3.20	180
27.0 ±10% 50 2.52 12.0	3.60	170
33.0 ±10% 50 2.52 11.0	4.00	160
39.0 ±10% 50 2.52 11.0	4.50	150
47.0 ±10% 50 2.52 10.0	5.00	140
56.0 ±10% 50 2.52 9.0	5.50	135
68.0 ±10% 50 2.52 9.0 82.0 ±10% 50 2.52 8.0	6.00	130 120
82.0 ±10% 50 2.52 8.0 100.0 ±10% 50 .79 8.0	7.00 8.00	110
120.0 ±10% 40 .79 6.0	8.00	110
150.0 ±10% 40 .79 5.0	9.00	105
180.0 ±10% 40 .79 5.0	9.50	102
220.0 ±10% 40 .79 4.0	10.0	100
270.0 ±10% 40 .79 4.0	12.0	92
330.0 ±10% 40 .79 3.5	14.0	85
390.0 ±10% 40 .79 3.0	16.0	80
470.0 ±10% 40 .79 3.0	26.0	62
560.0 ±10% 30 .79 3.0	30.0	50
680.0 ±10% 30 .79 3.0	30.0	50
820.0 ±10% 30 .79 2.5	35.0	30
1000.0 ±10% 30 .25 2.5	40.0	30



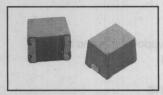


HOV	W TO ORDER	And the second	
	IMC-1812	10μΗ	± 10%
	MODEL	INDUCTANCE	INDUCTANCE
		VALUE	TOLERANCE

MODEL ISC-1812 Inductors

Surface Mount, Molded, Shielded





STANDARD ELECTRICAL SPECIFICATIONS

FEATURES

- Molded construction provides superior strength and moisture resistance
- Tape and reel packaging for automatic handling, 2000/reel, EIA 481
- Compatible with vapor phase and infra-red reflow soldering
- Shielded construction minimizes coupling to other components

ELECTRICAL SPECIFICATIONS

Inductance Range: .01µH to 1000µH.

Inductance Tolerance: $\pm 20\%$ for $.01\mu H$ to $.82\mu H$.

 \pm 10% for 1.0µH to 1000µH standard.

 \pm 10%, \pm 5%, \pm 3% available.

Temperature Range: - 40°C to + 105°C.

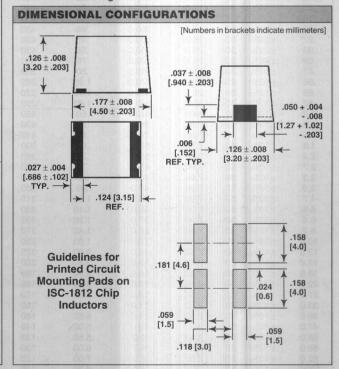
Coilform Material: Ceramic for .10μH to .82μH. Powdered Iron for 1.0μH to 22μH. Ferrite for 27μH to 1000μH.

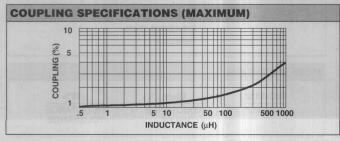
TEST EQUIPMENT

- H/P 4342A Q meter with Dale® test fixture or equivalent.
- H/P 4191A RF Impedance Analyzer (for SRF measurements).
- · Wheatstone Bridge.

PART MARKING

	Hajou	of his	TEST	SELF-	aloli ea	RATED
			FREQ.	RESONANT	DCR	DC CURRENT
IND.	TOI	Q MIN.	L&Q	FREQ. MIN.	MAX.	
(μ H)	TOL. ± 20%	30	(MHz) 25.2	(MHz) 460.0	(Ohms) .23	(mA) 450
.10	±20%	30	25.2	400.0	.26	450
.12	±20%	30	25.2	390.0	.29	450
.18	±20%	30	25.2	350.0	.32	450
.22	±20%	30	25.2	310.0	.36	450
.27	±20%	30	25.2	280.0	.40	450
.33	±20%	30	25.2	240.0	.45	450
.39	±20%	30	25.2	215.0	.60	410
.47	±20%	30	25.2	205.0	.75	370
.56	±20%	30	25.2	195.0	.80	355
.68	±20%	30	25.2	165.0	.95	310
.82	±20%	30	25.2	155.0	1.20	285
1.0	±20%	30	7.96	140.0	.35	150
1.2	±20%	30	7.96	120.0	.38	145
1.5	±20%	30	7.96	100.0	.40	140
1.8	±20% +20%	30	7.96 7.96	90.0 80.0	.43	130 120
2.7	±20%	30	7.96	67.0	.40	110
3.3	±20%	30	7.96	61.0	.55	105
3.9	±20%	30	7.96	56.0	.59	100
4.7	±20%	30	7.96	50.0	.62	92
5.6	±20%	30	7.96	40.0	.63	86
6.8	±20%	30	7.96	32.0	.75	80
8.2	±20%	30	7.96	30.0	.82	75
10.0	±10%	50	2.52	25.0	.90	70
12.0	±10%	50	2.52	22.0	1.0	65
15.0	±10%	50	2.52	18.0	1.10	60
18.0	±10%	50	2.52	15.0	1.24	57
22.0	±10%	50	2.52	14.0	1.36	54
27.0	±10%	50	2.52	13.0 12.0	1.56	50
33.0	± 10% ± 10%	50	2.52 2.52	11.0	1.72 1.89	47 44
47.0	± 10%	50 50	2.52	9.0	2.10	44
56.0	±10%	50	2.52	8.0	2.34	39
68.0	±10%	50	2.52	7.6	2.60	36
82.0	±10%	50	2.52	7.2	2.86	34
100.0	±10%	50	.796	7.0	3.25	32
120.0	±10%	50	.796	6.0	3.64	30
150.0	±10%	50	.796	5.0	4.16	28
180.0	±10%	40	.796	4.5	5.72	26
220.0	±10%	40	.796	4.2	6.30	24
270.0	±10%	40	.796	4.0	6.90	23
330.0	±10%	40	.796	3.7	7.54	22
390.0	±10%	40	.796	3.5	8.20	21
470.0	±10%	40	.796	3.3	9.20	19
560.0	±10%	40 40	.796	2.8	10.50	18 17
680.0 820.0	±10% ±10%	40	.796 .796	2.6	13.50	16





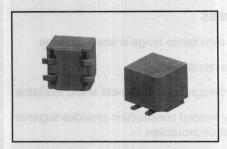
	— Date code	
HOW TO ORDER		
ISC-1812	10μΗ	± 10%
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE

- Inductance value

- Dale

MODEL IS Inductors Surface Mount





FEATURES

- · High Q
- Low EMI
- · Compatible with autoplace equipment
- Wide inductance range with low copper losses
- · Compatible with wave, vapor phase reflow and infrared reflow soldering
- EIA PDP-100 standard package outline No. SOPM-6464
- 16mm tape and reel package available per EIA 481 standard

STANDARD ELECTRICAL SPECIFICATIONS															
TOROID	IND.	TOL	Q	TEST FREQ. L & Q	SELF- RESONANT FREQ. MIN.	DCR MAX.	INCRE-* MENTAL CURRENT	POT CO	IND.	TOI	Q	TEST FREQ. L & Q	SELF- RESONANT FREQ. MIN.	DCR MAX.	INCRE-* MENTAL CURRENT
MODEL	(μH)	TOL.	MIN.	(kHz)	(kHz)	(Ohms)	(mA)	MODEL	(μ H)	TOL.	MIN.	(kHz)	(kHz)	(Ohms)	(mA)
IS-21	40000	± 10%	30	10	80	6.0	1	IS-22	25000	± 40%	70	50	400	8.0	7
	2500	± 10%	13	50	400	8.0	75		10000	± 40%	80	50	750	5.0	10
	2000	± 10%	15	50	800	5.0	100		1000	± 40%	50	50	2000	.5	25
	1000	± 10%	18	50	1200	3.0	140		200	± 40%	50	50	10000	.2	60
	100	± 10%	5	50	5000	1.8	160								

^{*} Incremental Current: The DC current required to cause a 50% reduction in the nominal inductance value.

ELECTRICAL SPECIFICATIONS

Inductance Range: 100µH to 40,000µH.

Inductance Tolerance: IS-21 = \pm 10%. IS-22 = \pm 40%.

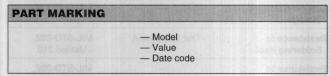
Temperature Range: - 20°C to + 105°C.

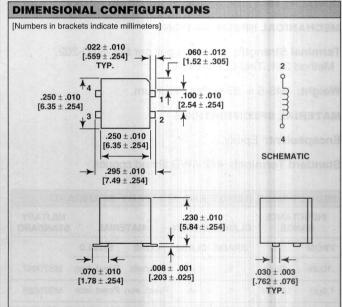
Incremental Current: The DC current required to cause a

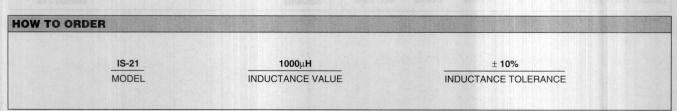
50% reduction in the nominal inductance value.

TEST EQUIPMENT

- H/P 4192A Impedance Analyzer (for Inductance and Q measurements).
 Test Frequency per Table, Test Voltage = 100 mV RMS.
- H/P 654A Audio Oscillator (for SRF measurements).
- ESI Model Number 1700 (for DCR measurements).



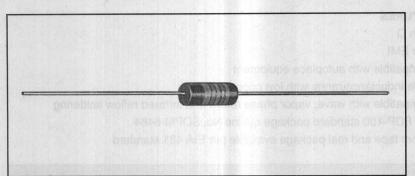




MODEL IMS-5 Inductors

Military, MIL-C-15305 Qualified, Type LT and Commercial, Molded, Shielded





FEATURES

- Wide inductance range in small package
- · Flame retardant coating
- Electromagnetic shield-finest shield available
- Epoxy molded construction provides superior moisture protection
- Precision performance, excellent reliability, sturdy construction

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 10% standard. ± 5% available.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Withstanding Voltage: 1000 VAC per

MIL-STD-202, Method 301 (sea level).

Percent Coupling: 3% maximum per MIL-C-15305.

Operating Temperature Range: - 55°C to + 105°C.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pounds pull per MIL-STD-202,

Method 211, Test Condition A.

Weight: IMS-5 = .85 grams maximum.

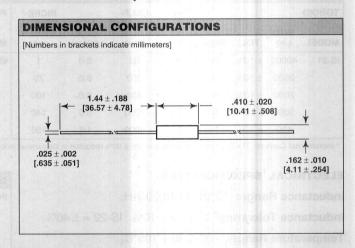
MATERIAL SPECIFICATIONS

Encapsulant: Epoxy.

Standard Terminal: #22 AWG tinned copper.

INDUCTANCE RANGE AND MILITARY STANDARD								
	CTANCE	CLASSIF	ICATION	MATE	ERIAL	MILITARY STANDARD		
FROM	то	GRADE	CLASS	CORE	SHIELD			
.10μΗ	.82μΗ	1	Α	Phenolic	Powd. Iron	MS75087		
1.0μΗ	12.0μΗ	1	Α	Powd. Iron	Powd. Iron	MS75088		
15.0μΗ	100,000μΗ	1	Α	Ferrite	Ferrite	MS75089*		

^{*} Not QPL'd.



ENVIRONMENTAL	PERFORMANCE	Patropaga and California
TEST	CONDITIONS	SPECIFICATIONS
Barometric Pressure	Test Condition C	MIL-STD-202, Method 105
Thermal Shock	Test Condition A-1	MIL-STD-202, Method 107
Flammability		MIL-STD-202, Method 111
Overload		MIL-C-15305
Low Temperature Storage		MIL-C-15305
Resistance to Soldering Heat	Test Condition A	MIL-STD-202, Method 210
Resistance to Solvents	<u> </u>	MIL-STD-202, Method 215

	- 10/0	•	201	77	1.0	100.0	.19	000	
2.7	± 10%	-6	208	44	7.9	92.0	.28	535	
3.3	± 10%	7	209	44	7.9	85.0	.35	480	在中央支票的 以
3.9	± 10%	-8	210	44	7.9	75.0	.40	450	LIZE E DE SEE LE SE
4.7	± 10%	-9	211	44	7.9	70.0	.55	380	10.05 to 10.05
5.6	± 10%	-10	212	44	7.9	65.0	.72	335	VS. Chikan La Sila
6.8	± 10%	redes seriish ourle	213	50	7.9	55.0	1.02	280	
8.2	± 10%	-12	214	50	7.9	50.0	1.32	250	1. 2.7.5 型 (1.1)型 2.7.5
10.0	± 10%	-13	215	50	7.9	46.0	1.62	220	
12.0	± 10%	-14	216	55	2.5	44.0	2.0	200	De Al Grande
		MS75089 (Not QPL'd)	LT10K		The state of the s	031		STITU PAGE	SHEET AND THE TAIL
15.0	± 10%	-1	217	45	2.5	49.0	.80	315	250.0
18.0	± 10%		218	45	2.5	45.0	.89	300	235.0
22.0	± 10%	-2 -3	219	45	2.5	41.0	.96	290	220.0
27.0	± 10%	-4	220	45	2.5	38.0	1.19	260	200.0
33.0	± 10%	- 	221	45	2.5	34.0	1.37	240	190.0
39.0	± 10%	-5 -6	222	50	2.5	29.0	1.93	205	180.0
	± 10%	-7	223	50	2.5	27.0	2.11	195	175.0
47.0	± 10%	-/	224	50	2.5	25.0	2.23	190	175.0 160.0 150.0
56.0	± 10%	-8 -9	225	50	2.5	21.0	2.70	170	150.0
68.0	± 10%				2.5		2.70		140.0
82.0	± 10%	-10	226	50	2.5 2.5	10.5	2.44 3.12	180	140.0 120.0
100.0	± 10%	-11	227	50	2.5	10.0	3.12	160	120.0 0F.0
120.0	± 10%	-12	228	55	.79	9.7	3.6	150	95.0 90.0
150.0	± 10%	-13	229	55	.79	8.5	4.1	140	90.0
180.0	± 10%	95 (350 -14 of 500)	230	55	.79	8.0	4.4	135	85.0 80.0
220.0	± 10%	-15	231	55	.79	7.5	5.0	125	80.0
270.0	± 10%	-16	232	55	.79	7.0	5.8	115	70.0
330.0	± 10%	-17	233	55	.79	6.5	6.4	110	70.0 65.0 60.0
390.0	± 10%	-18	234	60	.79	6.2	7.4	105	60.0
470.0	± 10%	-19	235	60	.79	5.7	9.5	92	58.0
560.0	± 10%	-20	236	60	.79	4.7	10.5	90	55.0
680.0	± 10%	-21	237	60	.79	4.5	11.8	80	50.0
820.0	± 10%	-22	238	60	.79	4.2	13.0	80	45.0
1000.0	± 10%	-23	239	60	.25	3.8	17.5	70	45.0 40.0
1200.0	± 10%	-24	240	45	.25	1.5	22.1	60	35.0
1500.0	± 10%	-25	241	45	.25	1.2	26.5	55	33.0
1800.0	± 10%	-26	242	45	.25	1.0	29.9	50	30.0
2200.0	± 10%	-27	243	45	.25	.97	33.8	50	27.0
2700.0	± 10%	-28	244	45	.25	.92	47.3	40	25.0
3300.0	± 10%	-29	245	45	.25	.84	53.0	40	22.0
3900.0	± 10%	-30	246	45	.25	.80	53.0 73.8	35	20.0
4700.0	± 10%	-31	247	45	.25	.74	81.6 98.9	31	19.0
5600.0	± 10%	-32	248	44	.25	.73	98.9	28	17.0
6800.0	± 10%	-33	249	40	.25	.66	111.0	27	16.0
8200.0	± 10%	-34	250	40	.25	.54	119.0	26	16.0 15.0
10000.0	± 10%	-35	251	40	.079	.47	137.0	24	14.0
12000.0	± 10%	-36	252	30	.079	.33	119.0 137.0 143.0	23	13.0
15000.0	± 10%	-37	253	30	.079	.29	157.0	22	12.0
18000.0	± 10%	-38	254	30	.079	.28	157.0 175.0	21	10.0
22000.0	± 10%	-39	255	27	.079	.25	274.0	17	9.0
27000.0	± 10%	-40	256	27	.079	.21	308.0	16	8.0
33000.0	± 10%	-41	257	27	.079	.19	343.0	15	7.5
39000.0	± 10%	-42	258	27	.079	.17	376.0	15	6.0
47000.0	± 10%	-43	259	23	.079	.16	473.0	13	5.5
56000.0	± 10%	-43	260	23	.079	.14	512.0	13	5.0
68000.0	± 10% ± 10%	-44 -45	261	23	.079	.13	580.0	12	4.0
	± 10% ± 10%	-45 -46	262	21	.079		619.0		3.5
82000.0						.12	618.0	11	3.5
100000.0	± 10%	-47	263	18	.079		678.0	11	3.0

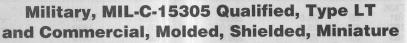
NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

HOW T	ORDER	
IMS-5	10μΗ	± 10%
MODEL	IND. VALUE	IND. TOLERANCE

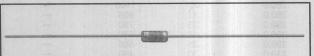
HOW TO ORDER - I	MILITARY P	ART	NUM	BER		
MS75088	-13	OB	LT	10	K	215
MILITARY STANDARD	IND. VALUE	Un	TYPE	GRADE AND CLASS	FAMILY	ID NUMBER

^{*} Measured with full length lead. ** Rated DC current based on maximum temperature rise not to exceed 15°C at 90°C ambient.
*** Incremental Current: The minimum typical current at which the inductance will be decreased by 5% from its initial zero DC value.

MODEL IMS-2 Inductors







FEATURES

- Electromagnetic shield
- Small package for a shielded inductor
- Flame retardant coating
 Epoxy molded construction provides superior moisture protection
 - Precision performance, excellent reliability, sturdy construction

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 10% standard. ± 5% available. Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Withstanding Voltage: 200 VAC per MIL-STD-202, Method 301 (sea level).

Percent Coupling: 3% maximum per MIL-C-15305. Operating Temperature Range: - 55°C to + 105°C.

MECHANICAL SPECIFICATIONS

Terminal Strength: 3 pounds pull per MIL-STD-202, Method 211, Test Condition A except 180° rotation for a total of 540°.

Weight: IMS-2 = .30 grams maximum.

MATERIAL SPECIFICATIONS

Encapsulant: Epoxy.

Standard Terminal: #24 AWG tinned copper.

TEST EQUIPMENT*

- H/P 4342A Q-Meter.
- · Measurements Corporation Megacycle Meter, Model 59.

DIME	NSIONAL CON	IGURA'	TIONS	
	1.50 ± .120 (38.10 ± 3.05)	limeters]	.250 ± .010 [6.35 ± .254]	.095 ± .010 [2.41 ± .254]

TEST	CONDITIONS	SPECIFICATIONS
Barometric Pressure	Test Condition C	MIL-STD-202, Method 105
Thermal Shock	Test Condition A-1	MIL-STD-202, Method 107
Flammability		MIL-STD-202, Method 111
Overload		MIL-C-15305
Low Temperature Storage		MIL-C-15305
Resistance to Soldering Heat	Test Condition A	MIL-STD-202, Method 210
Resistance to Solvents		MIL-STD-202, Method 215

STA	NDAR	D ELE	CTRI	CAI	L SPE	CIFICAT	IONS		
IND. (μH)	TOL.	MIL. STD.	MIL. TYPE	Q MIN.		SELF-* RESONANT FREQ. MIN. (MHz)		RATED** DC CURRENT (mA)	INCRE-*** MENTAL CURRENT
15.0 18.0 22.0 27.0 33.0 39.0 47.0 56.0 68.0 82.0	± 10% ± 10%	MS21426 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13 -14 -15 -16 -17 -18 -19 -20 -21 -22 -23 -24 -25 -26 -27 -28 -29 -30 -31 -32 -33 -34 -35 -36 -37	518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 537 538 539 541 542 543 544 545 546 547 548 549 551 553 554	54 52 50 49 47 46 44 41 41 43 38 37 40 41 43 55 55 57 63 88 40 40 40 41 44 44 44 44 44 45 46 46 47 47 48 48 49 49 49 49 49 49 49 49 49 49 49 49 49	25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0	490.0 430.0 415.0 375.0 330.0 260.0 220.0 210.0 165.0 150.0 130.0 115.0 90.0 80.0 70.0 60.0 55.0 53.0 50.0 24.0 21.0 20.0 21.0 20.0	.10 .11 .12 .13 .15 .16 .19 .21 .23 .24 .27 .30 .73 .86 .95 .1.1 .1.2 .1.3 .2.4 .2.9 .3.6 .4.0 .3.4 .3.8 .4.0 .3.1 .5.1 .5.1 .6.1 .6.1 .6.1 .6.1 .6.1 .6	670 635 610 585 545 530 495 485 460 440 430 405 385 247 228 217 202 193 185 173 136 124 118 111 106 122 115 108 96 88 83 75 69 64 61 59 51	
150.0 180.0 220.0 270.0 330.0 390.0 470.0) ± 10%) ± 10%	MS21427 -1 -2 -3 -4 -5 -6 -7 -8 -9	555 556 557 558 559 560 561 562 563	31 33 33 35 37 40 38 36 36	.79 .79 .79 .79 .79 .79 .79 .79	13.0 12.0 11.0 10.0 9.0 8.0 7.8 7.5 7.0	5.8 7.9 9.4 11.0 12.0 16.0 21.0 24.0 28.0	88 75 69 64 61 53 46 43 40	27 24 22 20 18 16 14 13

* Measured with full length lead.

** Rated DC current based on the maximum temperature rise not to exceed 15°C at 90°C ambient.

*** Incremental Current: The minimum typical current at which the inductance will be decreased by 5% from its initial zero DC value.

INDUCTANCE RANGE		CLASSIF	ICATION	MATERIAL		MILITARY STANDARD	
FROM	то	GRADE	CLASS	CORE	SHIELD		
.10μΗ	100μΗ	1	Α	Powd. Iron	Powd. Iron	MS21426	
120µH	560µH	1	Α	Ferrite	Ferrrite	MS21427	

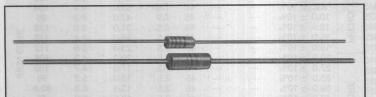
NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

HOW TO	ORDER	THE CHARLEST AND THE STREET	HOW TO ORDER - I	MILITARY F	PART	NUM	BER		
IMS-2	10μΗ	± 10%	MS21426	-14	OB	LT	10	K	531
MODEL	IND. VALUE	IND. TOLERANCE	MILITARY STANDARD	IND. VALUE	UH	TYPE	GRADE AND CLASS	FAMILY	ID NUMBER

MODEL IMInductors







INDUC.	TANCE RA	NGE AND	MILITA	RY STAI	NDARD
		NCE RANGE in bold face	CLASSII	FICATION	MILTARY
MODEL	FROM	то	GRADE	CLASS	STANDARD
IM-1	.10μΗ	1000μΗ	-	815 <u>-</u> - 835	Takis in a - ness
IM-2	.022µH	.082μΗ	NO ME		
	.10µH	1µH	1	В	MS75083
	1.2μΗ	27µH	1	A	MS75084
	33µH	1000μΗ	1	A	MS75085
IM-4	.15µH	4.7μΗ	1	В	MS18130
	5.6µH	33µH	1	Α	MS14046
	36µH	240µH	1	Α	MS90538
	270μΗ	1800μΗ	3 US		
IM-6	.10μΗ	2.7μΗ	1	В	MS75008 Not QPL'd
	3.3µH	27μΗ	1	A	MS75101 Not QPL'd
	33µH	220µH	0 -	5 to E	
	270μΗ	1000μΗ	1	Α	MS90539 Not QPL'd
IM-8	1100μΗ	3600μΗ	1	Α	MS90540 Not QPL'd
IM-9	68µH	150μΗ	5 1	Α	MS14047 Not QPL'd
IM-10	3900uH	10 000uH	1	Δ	MS90541 Not OPI 'd

DIMENSIONAL CONFIGURATIONS C TYP. A DIA. D DIA.

Numbe	rs in	brackets	indicate	millimeters	

MODEL		A (Dia.)	В	C (Typ.)	D (Dia.)
IM-1	Maximum	.086 [2.18]	.210 [5.33]	1.62 [41.15]	.0215 [.546]
	Minimum	.070 [1.78]	.190 [4.83]	1.38 [35.05]	.0185 [.470]
IM-2	Maximum	.105 [2.67]	.260 [6.60]	1.63 [41.40]	.0215 [.546]
	Minimum	.085 [2.16]	.240 [6.10]	1.25 [31.75]	.0185 [.470]
IM-4	Maximum	.165 [4.19]	.385 [9.78]	1.63 [41.40]	.027 [.686]
	Minimum	.145 [3.68]	.365 [9.27]	1.25 [31.75]	.023 [.584]
IM-6	Maximum	.200 [5.08]	.450 [11.43]	1.63 [41.40]	.027 [.686]
	Minimum	.180 [4.57]	.430 [10.92]	1.25 [31.75]	.023 [.584]
IM-8	Maximum	.225 [5.72]	.570 [14.48]	1.63 [41.40]	.030 [.762]
	Minimum	.205 [5.21]	.550 [13.97]	1.25 [31.75]	.026 [.660]
IM-9	Maximum	.260 [6.60]	.570 [14.48]	1.63 [41.40]	.027 [.686]
	Minimum	.240 [6.10]	.550 [13.97]	1.25 [31.75]	.023 [.580]
IM-10	Maximum	.250 [6.35]	.750 [19.05]	1.63 [41.40]	.034 [.864]
	Minimum	.230 [5.84]	.730 [18.54]	1.25 [31.75]	.030 [.762]

FEATURES

- Wide inductance range in small package
- Flame retardant coating
- Precision performance, excellent reliability, sturdy construction
- Epoxy molded construction provides superior moisture protection

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: \pm 1%, \pm 3%, \pm 5%, \pm 10%, \pm 20%. Other tolerances available on request.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Strength: Per MIL-STD-202, Method 301: 1000 VAC for IM-2, -4, -6, -8, -9 and -10. 200 VAC for IM-1.

MECHANICAL SPECIFICATIONS

Terminal Strength: Per MIL-STD-202, Method 211, Test Condition A: For IM-1, 3 pounds pull.

For IM-2, -4, -6, -8, -9 and -10, 5 pounds pull and twist.

Weight: IM-1 = .25 gram maximum,

IM-2 = .30 gram maximum,

IM-4 = .65 gram maximum,

IM-6 = .95 gram maximum,

IM-8 = 1.5 gram maximum,

IM-9 = 2.0 gram maximum, IM-10 = 2.5 gram maximum.

MATERIAL SPECIFICATIONS

Encapsulant: Epoxy.

Standard Terminals: IM-1 and IM-2, 24 AWG; IM-4, IM-6 and IM-9, 22 AWG; IM-8, 21 AWG; and IM-10, 20 AWG, Tinned Copper.

TEST EQUIPMENT*

- H/P 4342A Q-Meter.
- Measurements Corporation Megacycle Meter, Model 59.
- · Wheatstone Bridge.
- * Test procedures per MIL-C-15305.

ENVIRONMENTAL	PERFORMANCE	Transport
TEST	CONDITIONS	SPECIFICATIONS
Barometric Pressure	Test Condition C	MIL-STD-202, Method 105
Thermal Shock	Test Condition A-1	MIL-STD-202, Method 107
Flammability		MIL-STD-202, Method 111
Overload		MIL-C-15305
Low Temperature Storage		MIL-C-15305
Resistance to Soldering Heat	Test Condition A	MIL-STD-202, Method 210
Resistance to Solvents		MIL-STD-202, Method 215

MODE		ELECI	HICA	L SI	TEST	SELF-*		RATED**	MODE	L IM-1				TEST	SELF-*		RATED**
IND.	TOL.	MIL. STD.	MIL. TYPE	Q MIN.	FREQ. L & Q	RESONANT FREQ. MIN. (MHz)		DC	IND.	TOL.	MIL. STD.	MIL. TYPE	Q MIN.	FREQ. L & Q	RESONANT FREQ. MIN. (MHz)		DC CURRENT
.10 .12 .15 .18 .22 .27 .33 .39 .47	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	- V		35 35 35 35 30 30 25 25 25	25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0	680.0 650.0 560.0 540.0 500.0 440.0 410.0 380.0 340.0	.13 .15 .18 .21 .25 .38 .49 .59 .62	895 835 760 705 645 525 460 420 410 510	3.9 4.7 5.6 6.8 8.2 10.0 12.0 15.0 18.0 22.0	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	signer		50 55 55 55 45 45 40 40 40 45	7.9 7.9 7.9 7.9 7.9 7.9 2.5 2.5 2.5 2.5	95.0 88.0 78.0 69.0 52.0 47.0 31.0 26.0 23.0 20.0	1.5 2.1 2.8 3.2 4.4 5.2 3.0 3.4 3.8 4.3	178 150 130 122 104 95 126 118 112 00 105
.68 .82 1.0 1.2 1.5 1.8 2.2 2.7 3.3	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	qu=seb		40 40 40 35 40 40 45 45 45	25.0 25.0 25.0 7.9 7.9 7.9 7.9 7.9 7.9	215.0 200.0 190.0 170.0 150.0 135.0 130.0 110.0	.20 .22 .25 .28 .49 .56 .72 .85	485 465 435 410 310 290 257 236 198	33.0 39.0 47.0 56.0 68.0 82.0 100.0	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	NOT		45 45 45 45 45 45 45 45	2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	17.0 15.0 13.5 12.5 11.5 10.5 10.0 9.5	4.7 5.2 6.8 8.2 10.0 11.5 16.0 17.5	105 100 95 83.5 76 69 64 54.5 52
.022 .027 .033 .039 .047 .056 .068	± 20% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	100 University (100 University		50 40 40 40 40 40 40 40	50.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0	900.0 875.0 850.0 825.0 800.0 775.0 750.0 725.0	.025 .03 .035 .04 .045 .05 .06	2400 WE 2200 OO 2000 OO 1900 OO 1800 OO 1700 NU 1500 H 1400	5.6 6.8 8.2 10.0 12.0 15.0 18.0		-10 -11 -12 -13 -14 -15	LT10K 069 070 071 072 073 074 075 076	50 50 55 55 45 40 50	7.9 7.9 7.9 7.9 2.5 2.5 2.5 2.5	65.0 60.0 55.0 50.0 40.0 35.0 30.0 25.0	1.8 2.0 2.7 3.7 2.7 2.8 3.1 3.3	185 175 155 130 155 150 150 145
.10 .12 .15 .18 .22 .27 .33 .39 .47 .56 .68 .82	± 10% ± 10%	MS75083 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13	LT4K 339 340 341 342 343 344 345 346 347 348 349 350 351 LT10K	40 40 38 35 33 30 30 30 30 28 28 25	25.0 25.0 25.0 25.0 25.0 25.0 25.0 25.0	680.0 640.0 600.0 550.0 510.0 430.0 410.0 365.0 330.0 275.0 250.0 230.0	.08 .09 .10 .12 .14 .16 .22 .30 .35 .50 .60 .85	1350 1270 1200 1105 1025 960 960 970 960 960 960 960 960 960 100 100 100 100 100 100 100 100 100 1	27.0 33.0 39.0 47.0 56.0 68.0 82.0 100.0 120.0 180.0 220.0	± 10% ± 10% ± 10% ± 10% ± 10%	MS75085 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11	077	50	2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.7 79 .79	20.0 24.0 22.0 20.0 18.0 15.0 14.0 13.0 12.0 11.0 9.0 8.0	3.5 3.4 3.6 4.5 5.7 6.7 7.3 8.0 13.0 15.0 21.0 25.0	135 130 125 110 100 92 88 84 66 61 57 52 47
1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	-01 -02 -03 -04 -05 -06 -07 -08	061 062 063 064 065 066 067 068	25 28 30 30 37 45 45 45	7.9 7.9 7.9 7.9 7.9 7.9 7.9 7.9	150.0 140.0 125.0 115.0 100.0 90.0 80.0 75.0	.18 .22 .30 .40 .55 .85 1.0	590 535 455 EC 395 O 355 N 270 OE 250 230	390.0 470.0 560.0 680.0 820.0 1000.0	± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	-14 -15 -16 -17 -18	090 091 092 093 094 095 096	30 30 30 30 30 30 30	.79 .79 .79 .79 .79 .79	7.0 6.5 6.0 5.0 4.0 3.8 3.4	28.0 35.0 42.0 46.0 60.0 65.0 72.0	45 40 36 35 30 29 28
		MS18130					atotes	old -		EL IM-4	MS90538						
.15 .22 .33 .47 .56 .68 .82 1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7	± 20% ± 20% ± 20% ± 20% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	-1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13 -14 -15 -16	074 075 076 077 078 079 080 081 082 083 084 085 086 087	50 50 45 45 50 50 50 33 33 33 33 33 33 33	25.0 25.0 25.0 25.0 25.0 25.0 25.0 7.9 7.9 7.9 7.9 7.9 7.9	525.0 450.0 360.0 310.0 280.0 250.0 220.0 200.0 180.0 150.0 135.0 120.0 110.0 100.0 90.0	.03 .055 .09 .12 .135 .15 .22 .29 .42 .50 .65 .95 1.20 2.30 2.30	2450 1810 1400 1225 1150 900 785 650 650 525 435 385 380 280 260	110.0 120.0 130.0 150.0	±5% ±5% ±5% ±5% ±5% ±5% ±5% ±5% ±5% ±5%	-1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11 -12 -13 -14 -15 -16 -17	001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017	60 60 55 55 55 55 55 50 60 65 65 65	2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5	15.5 14.5 13.7 13.0 12.7 12.0 11.5 11.0 10.5 10.3 10.0 9.5 8.7 8.5 8.0 7.5	2.50 2.60 2.70 2.75 2.85 3.0 3.15 3.30 3.70 4.30 4.50 4.90 5.20 5.45 6.05 6.40	180 176 172 170 167 164 160 156 147 143 136 133 128 124 121 111
12.0 15.0 18.0 22.0 27.0	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	MS14046 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10	128 129 130 131 132 133 134 135 136 137	45 50 50 55 65 65 75 75 60 65	7.9 7.9 7.9 7.9 2.5 2.5 2.5 2.5 2.5	60.0 55.0 50.0 45.0 42.0 40.0 34.0 30.0 25.0 19.0	.32 .50 .60 .90 1.10 1.40 2.25 2.50 2.60 3.0	495 395 360 290 CO 265 O 2 240 O 2 185 OC 175 170 165	180.0 200.0 220.0 240.0 270.0 300.0 NOT qual	± 5% ± 5% ± 5% ± 5% ± 5% ± 5%	-18 -19 -20 -21 sting of Mon. Conta	018 019 020 021 — — Hilitary	65 65 65 65 65 65	.79 .79 .79 .79 .79 .79 .79	7.5 7.0 6.5 6.2 5.9 5.7 5.4 does not i	6.75 7.10 7.45 7.80 11.0 11.5	108 106 103 101 129 125

.27 .33 .39 .47 .56	± 10% ± 10% ± 10% ± 10% ± 10%	-23 -24 -25 -26	029 030 031 032	50 50 50 50 50 45	25.0 25.0 25.0 25.0 25.0 25.0	380.0 350.0 320.0 300.0 270.0 250.0	.050 .065 .080 .085 .125	2400 2000 1800 1700 1450 1300 1100 1100 1300		82.0 ± 10% 100.0 ± 10% 120.0 ± 10% 150.0 ± 10% 180.0 ± 10% 220.0 ± 10%			75 65 65 65 65 65	2.5 2.5 .79 .79 .79	10.0 8.0 6.0 5.4 5.0 4.7	5.3 6.0 5.0 5.8 6.6 7.4	143 133 124 118 114 112	IRON C
.82 1.0 1.2 1.5 1.8 2.2	± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	-27 -28 -29 -30 -31 -32 -33	032 033 034 035 036 037 038 039	40 40 30 30 30 30 30 30	25.0 25.0 7.9 7.9 7.9 7.9 7.9	210.0 200.0 180.0 170.0 150.0 140.0	.205 .290 .400 .485 .740 .970	1100 930 785 700 580 505 460	PHE	270.0 ± 5% 300.0 ± 5% 330.0 ± 5% 360.0 ± 5% 390.0 ± 5%	MS90539 -01 -02 -03 -04 -05	LT0K 022 023 024 025 026	(Not 0 65 65 65 65 65	QPL'd) .79 .79 .79 .79 .79	5.6 5.3 5.0 4.7 4.5	8.2 8.7 9.1 9.6 10.0	110 107 105 102 100	UDT HIO LISH
3.3 3.9 4.7 5.6 6.8 8.2 10.0 12.0	± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10% ± 10%	-33 MS7510 ⁻ -01 -02 -03 -04 -05 -06 -07 -08	-	30 30 30 30 30 30 30 30 30 50	QPL'd) 7.9 7.9 7.9 7.9 7.9 7.9 7.9 2.5	70.0 65.0 60.0 50.0 50.0 48.0 42.0 36.0	.140 .155 .210 .280 .375 .440 .605 1.05	990 870 745 645 560 540 440 370	HON CORE	430.0 ± 5% 470.0 ± 5% 510.0 ± 5% 560.0 ± 5% 620.0 ± 5% 680.0 ± 5% 750.0 ± 5% 820.0 ± 5% 910.0 ± 5% 1000.0 ± 5%	-06 -07 -08 -09 -10 -11 -12 -13 -14 -15	027 028 029 030 031 032 033 034 035 036	65 65 65 60 60 60 60 60	.79 .79 .79 .79 .79 .79 .79 .79	4.3 4.0 3.8 3.6 3.5 3.4 3.3 3.1 2.9 2.8	10.6 11.1 11.6 12.3 13.0 13.7 14.4 15.1 15.8 16.5	97 95 93 91 88 85 83 81 79	IRON CORE
22.0 27.0	± 10% ± 10% ± 10% ± 10%	-09 -10 -11 -12	177 178 179 180	55 60 60 65	2.5 2.5 2.5 2.5	30.0 30.0 24.0 22.0	1.20 1.95 2.20 2.75	310 = 255 240 205		68.0 ± 10% 82.0 ± 10% 100.0 ± 10%	MS14047 -01 -02 -03	LT10K 138 139 140	(Not 70 65 65	QPL'd) 2.5 2.5 2.5	13.0 11.7 10.7	3.3 3.5 3.8	168 162 155	CORE
1100.0 1200.0	0 ± 5% 0 ± 5%	MS90540 -01 -02	037 038	60	QPL'd) .25 .25	2.8 2.7	21.0 22.0	78 76		120.0 ± 10% 150.0 ± 10% MODEL IM-10	-04 -05	141 142	75 75	.79 .79	9.3 8.3	4.7 5.3	142 132	IRON
1500.0 1600.0 1800.0 2000.0 2200.0 2400.0 2700.0 3000.0 3300.0	0 ±5% 0 ±5%	-03 -04 -05 -06 -07 -08 -09 -10 -11 -12 -13	039 040 041 042 043 044 045 046 047 048 049	60 65 65 65 70 70 70 70 70	.25 .25 .25 .25 .25 .25 .25 .25 .25 .25	2.6 2.4 2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5	23.0 25.0 26.0 28.0 29.0 30.0 31.0 33.0 35.0 38.0 40.0	75 72 70 68 67 66 64 62 61 58 57	HON COHE	3900.0 ± 5% 4300.0 ± 5% 4700.0 ± 5% 5000.0 ± 5% 5600.0 ± 5% 6200.0 ± 5% 6800.0 ± 5% 7500.0 ± 5% 8200.0 ± 5% 9100.0 ± 5% 10000.0 ± 5%	MS90541 -01 -02 -03 -04 -05 -06 -07 -08 -09 -10 -11	LT10K 050 051 052 053 054 055 056 057 058 059 060	80 80 80 80 80 80 80 80 80 80 80	QPL'd) .25 .25 .25 .25 .25 .25 .25 .25 .25 .25	1.45 1.40 1.35 1.30 1.25 1.20 1.15 1.10 1.05 1.0	44.0 46.0 48.0 50.0 53.0 56.0 59.0 62.0 65.0 68.0 72.0	61 59 58 57 56 54 52 51 50 49	IRON CORE

^{*} Measured with full length lead.

^{**} Rated DC current based on maximum temperature rise as shown in table:

MP. RANGE
5°C to + 125°C 5°C to + 105°C
5°C to + 125°C 5°C to + 105°C 5°C to + 105°C
5°C to + 125°C 5°C to + 105°C 5°C to + 105°C 5°C to + 125°C
5°C to + 125°C
5

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

NOTE: Products with dashes instead of Military Standard value and type designations are not qualified.

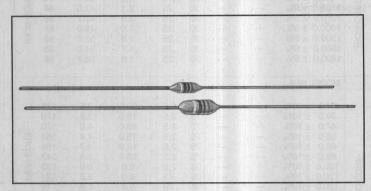
HOW TO	ORDER	学通过程序的
IM-2	10μΗ	± 10%
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE

HOW TO	ORDER - MI	LITARY	PART NUM	IBER	
MS75084	-12	OD LT	10	K	072
MILITARY	INDUCTANCE	TYPE	GRADE AND	FAMILY	ID NUMBER
STANDARD	VALUE		CLASS		

MODEL IRInductors

Epoxy Conformal Coated Uniform Roll Coated





FEATURES

- Flame-retardant coating
- · Color band identification
- Excellent environmental characteristics
- Uniform coating is excellent for automatic insertion
- Comparable in quality to molded chokes at a lower price
- Epoxy coating is more durable than lacquer coated models, yet is priced comparably

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: $\pm 1\%$, $\pm 3\%$, $\pm 5\%$, $\pm 10\%$, $\pm 20\%$. Other tolerances available on request.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Strength: 1000 VAC per MIL-STD-202,

Method 301.

MATERIAL SPECIFICATIONS

Coating: Epoxy-uniform roll coated.

Lead: Tinned Copper.

MECHANICAL SPECIFICATIONS

Terminal Strength: 5 pounds pull per MIL-STD-202, Method 211, Test Condition A.

Weight: IR-2 = .30 gram maximum. IR-4 = .65 gram maximum.

TEST EQUIPMENT*

- H/P 4342A Q-Meter.
- Measurements Corporation Megacycle Meter, Model 59.
- Wheatstone Bridge.
- * Test procedures per MIL-C-15305.

DIMENS	IONAL COI	A MAX.	1.25 [31. 1.63 [41.2	75] MIN
[Numbers in	brackets indicate A (Max.)	millimeters]	C (Max.)	D
IR-2	.260	.120	.330	.0200 ± .0015
IR-4	.385	.180	.440	.025 ± .002 [.635 ± .051]

ENVIRONMENTAL	PERFORMANCE	
TEST	CONDITIONS	SPECIFICATIONS
Barometric Pressure	Test Condition C	MIL-STD-202, Method 105
Thermal Shock	Test Condition A-1	MIL-STD-202, Method 107
Flammability	-	MIL-STD-202, Method 111
Overload		MIL-C-15305
Low Temperature Storage	_	MIL-C-15305
Resistance to Soldering Heat	Test Condition A	MIL-STD-202, Method 210
Resistance to Solvents		MIL-STD-202, Method 215

MAXIMUM TEMPERATURE RISE			
	OPERATING TEMP. RANGE		OPERATING TEMP. RANGE
IR-2 .1 to $1.0\mu H = 35^{\circ}C$ at $90^{\circ}C$ ambient. 1.2 to $27\mu H = 15^{\circ}C$ at $90^{\circ}C$ ambient. 33 to $1000\mu H = 15^{\circ}C$ at $90^{\circ}C$ ambient.	- 55°C to + 125°C - 55°C to + 105°C - 55°C to + 105°C	IR-4 .15 to $4.7\mu H = 35^{\circ}C$ at $90^{\circ}C$ ambient. 5.6 to $33\mu H = 15^{\circ}C$ at $90^{\circ}C$ ambient. 36 to $240\mu H = 15^{\circ}C$ at $90^{\circ}C$ ambient. 270 to $1800\mu H = 35^{\circ}C$ at $90^{\circ}C$ ambient.	- 55°C to + 125°C - 55°C to + 105°C - 55°C to + 105°C - 55°C to + 125°C

MODEL IR

STAN	DARD B	LECT	RICAL	SPECIFICA	TIONS										
MODEL			TEST	SELF-*	THAT IS A	RATED**	1 37	MODELI	R-2		TEST	SELF-*		RATED**	
IND. (μH)	TOL.	Q MIN.	FREQ. L & Q (MHz)	RESONANT FREQ. MIN. (MHz)	DCR MAX. (Ohms)	DC CURRENT (mA)		IND. (μH)	TOL.	Q MIN.	FREQ. L & Q (MHz)	RESONANT FREQ. MIN. (MHz)	DCR MAX. (Ohms)	DC CURRENT (mA)	The same of
.10	± 10%	40	25.0	680.0	.08	1350		12.0	± 10%	45	2.5	40.0	2.7	155	RON CORE
.12	± 10%	40	25.0	640.0	.09	1270		15.0	± 10%	40	2.5	35.0	2.8	150	0
.15	± 10%	38	25.0	600.0	.10	1200		18.0	± 10%	50	2.5	30.0	3.1	145	7
.18	± 10%	35	25.0	550.0	.12	1105	岩	22.0	± 10%	50	2.5	25.0	3.3	140	ō
.22	± 10%	33	25.0	510.0	.14	1025	PHENOLIC CORE	27.0	± 10%	50	2.5	20.0	3.5	135	田田
.27	± 10%	33	25.0	430.0	.16	960	0			AE	2.5	24.0	3.4	130	
.33	± 10%	30	25.0	410.0	.22	815	9	33.0	± 10%	45		22.0	3.6	125	
.39	± 10%	30	25.0	365.0	.30	700	ō	39.0	± 10% ± 10%	45	2.5	20.0	4.5	110	
.47	± 10%	30	25.0	330.0	.35	650	E	47.0		45	2.5		5.7	100	
.56	± 10%	30	25.0	300.0	.50	545	프	56.0	± 10%	45	2.5	18.0			
.68	± 10%	28	25.0	275.0	.60	495	-	68.0	± 10%	50	2.5	15.0	6.7	92	
.82	± 10%	28	25.0	250.0	.85	415		82.0	± 10%	50	2.5	14.0	7.3	88	77.35
1.0	± 10%	25	25.0	230.0	1.0	385		100.0	± 10%	50	2.5	13.0	8.0	84	#
					The second second	CONTRACTOR OF STREET		120.0	± 10%	30	.79	12.0	13.0	66	CORE
1.2	± 10%	25	7.9	150.0	.18	590		150.0	± 10%	30	.79	11.0	15.0	61	0
1.5	± 10%	28	7.9	140.0	.22	535		180.0	± 10%	30	.79	10.0	17.0	57	FERRITE
1.8	± 10%	30	7.9	125.0	.30	455		220.0	± 10%	30	.79	9.0	21.0	52	E H
2.2	± 10%	30	7.9	115.0	.40	395	ш	270.0	± 10%	30	.79	8.0	25.0	47	出
2.7	± 10%	37	7.9	100.0	.55	355	N N	330.0	± 10%	30	.79	7.0	28.0	45	П
3.3	± 10%	45	7.9	90.0	.85	270	CORE	390.0	± 10%	30	.79	6.5	35.0	40	
3.9	± 10%	45	7.9	80.0	1.0	250	IRON	470.0	± 10%	30	.79	6.0	42.0	36	
4.7	± 10%	45	7.9	75.0	1.2	230	2	560.0	± 10%	30	.79	5.0	46.0	35	
5.6	± 10%	50	7.9	65.0	1.8	185	=	680.0	± 10%	30	.79	4.0	60.0	30	
6.8	± 10%	50	7.9	60.0	2.0	175		820.0	± 10%	30	.79	3.8	65.0	29	
8.2	± 10%	55	7.9	55.0	2.7	155		1000.0	± 10%	30	.79	3.4	72.0	28	
10.0	± 10%	55	7.9	50.0	3.7	130									
MODEL	- IR-4	981	0.5					MODEL	IR-4	T, OL					1
.15	± 20%	50	25.0	525.0	.03	2450		75.0	± 5%	55	2.5	10.5	3.70	147	
.22	± 20%	50	25.0	450.0	.055	1810		82.0	± 5%	50	2.5	10.3	3.90	143	
.33	± 20%	45	25.0	360.0	.09	1400		91.0	± 5%	50	2.5	10.0	4.30	136	
.47	± 20%	45	25.0	310.0	.12	1225		100.0	± 5%	50	2.5	9.5	4.50	133	
.56	± 10%	50	25.0	280.0	.135	1150	in	110.0	± 5%	60	.79	8.9	4.90	128	
.68	± 10%	50	25.0	250.0	.15	1100	E	120.0	± 5%	65	.79	8.7	5.20	124	
.82	± 10%	50	25.0	220.0	.22	900	CORE	130.0	±5%	65	.79	8.5	5.45	121	
1.0	± 10%	50	25.0	200.0	.29	785	0	150.0	±5%	65	.79	8.0	6.05	114	
1.2	± 10%	33	7.9	180.0	.42	650	PHENOLIC	160.0	± 5%	65	.79	7.5	6.40	111	
1.5	± 10%	33	7.9	160.0	.50	600	Z	180.0	±5%	65	.79	7.0	6.75	108	
1.8	± 10%	33	7.9	150.0	.65	525	뿌	200.0	± 5%	65	.79	6.5	7.10	106	
2.2	± 10%	33	7.9	135.0	.95	435	ā	220.0	±5%	65	.79	6.2	7.45	103	
2.7	± 10%	33	7.9	120.0	1.20	385		240.0	±5%	65	.79	5.9	7.80	101	
3.3	± 10%	33	7.9	110.0	2.0	300		270.0	± 5%	65	.79	5.7	11.0	129	
3.9	± 10%	33	7.9	100.0	2.30	280		300.0	±5%	65	.79	5.4	11.5	125	111
4.7	± 10%	33	7.9	90.0	2.60	260		330.0	±5%	65	.79	5.1	12.0	123	H
5.6	± 10%	45	7.9	60.0	.32	495	The	360.0	± 5%	65	.79	4.8	15.5	108	IRON CORE
6.8	± 10%	50	7.9	55.0	.50	395		390.0	±5%	65	.79	4.5	16.3	105	Z
8.2	± 10%	50	7.9	50.0	.60	360		430.0	±5%	65	.79	4.2	17.1	102	2
10.0	± 10%	55	7.9	45.0	.90	290		470.0	±5%	65	.79	3.9	17.9	100	-
12.0	± 10%	65	2.5	42.0	1.10	265		510.0	±5%	65	.79	3.7	18.8	98	
								560.0	± 5%	65	.79	3.5	24.7	85	
15.0	± 10% ± 10%	65	2.5	40.0	1.40	240		620.0	±5%	65	.79	3.3	25.9	83	
18.0		75	2.5	34.0	2.25	185	3	680.0	±5%	55	.79	3.1	27.2	81	
22.0	± 10%	75	2.5	30.0	2.50	175	ORE	750.0	± 5%	55	.79	2.9	28.6	79	
27.0	± 10%	60	2.5	25.0	2.60	1/0	0	820.0	± 5%	55	.79	2.7	30.0	77	
33.0	± 10%	65	2.5	19.0	3.0	170 165 180	S	910.0	± 5%	55	.79	2.5	31.5	76	
36.0	± 5%	60	2.5	15.5	2.50	180	R	1000.0	± 5%	55	.79	2.3	33.1	74	
39.0	± 5%	60	2.5	14.5	2.60	110	ALCO S	1100.0	± 5%	30	.25	2.1	43.5	64	
43.0	± 5%	60	2.5	13.7	2.70	172		1200.0	± 5%	30	.25	2.0	45.7		
47.0	± 5%	55	2.5	13.0	2.75	170		1300.0	± 5% ± 5%		.25		49.0	61	
51.0	± 5%	55	2.5	12.7	2.85	167				30		1.9		59	
56.0	± 5%	55	2.5	12.0	3.0	164		1500.0	± 5%	30	.25	1.8	52.5		
62.0	± 5%	55	2.5	11.5	3.15	160		1600.0	±5%	30	.25	1.7	54.0	58	
02.0		55			3.30	100		1800.0	±5%	30	.25	1.6	56.7	56	

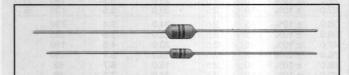
^{*} Measured with full length lead. ** Rated DC current based on maximum temperature rise as shown in table.

HOW TO ORDER				
		in nin divide passetal		
	IR-2 MODEL	10μΗ INDUCTANCE VALUE	± 10% INDUCTANCE TOLERANCE	

MODEL IRF Inductors

Epoxy Conformal Coated Uniform Roll Coated

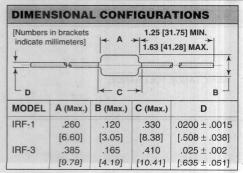




FEATURES

- Flame-retardant coating and color band identification
- Uniform coating is excellent for automatic insertion
- Available in bulk, ammo and reel pack per EIA RS-296
- Superior electrical specifications High Q and Self Resonant Frequency, Low DC resistance, High rated DC current

ODEL	IRF-1					RATED DC**	MODEL	IRF-3					RATED DC*
IND. (μH)	TOL.	Q MIN.	TEST FREQ. L & Q (MHz)	SRF MIN.* (MHz)	DCR MAX. (Ohms)	CURRENT (mA)	IND. (μH)	TOL.	Q MIN.	TEST FREQ. L & Q (MHz)	SRF MIN.* (MHz)	DCR MAX. (Ohms)	CURRENT (mA)
.10	± 20%	40	25.0	400.0	.06	1350	.22	± 20%	55	25.0	380.0	.10	1400
.12	± 20%	40	25.0	400.0	.06	1270	.27	± 20%	55	25.0	340.0	.11	1320
.15	± 20%	40	25.0	400.0	.07	1200	.33	± 20%	55	25.0	300.0	.12	1280
.18	± 20%	40	25.0	400.0	.075	1155	.39	± 20%	55	25.0	280.0	.13	1200
.22	± 20%	40	25.0	380.0	.075	1150	.47	± 20%	55	25.0	250.0	.14	1150
.27	± 20%	40	25.0	360.0	.08	1110	.56	± 20%	55	25.0	230.0	.15	1100
.33	± 20%	40	25.0	350.0	.08	1110	.68	± 20%	55	25.0	210.0	.16	1030
.39	± 20%	40	25.0	320.0	.09	1000	.82	± 20%	55	25.0	172.0	.17	980
.47	± 20%	40	25.0	300.0	.10	1000	1.0	± 10%	55	25.0	157.0	.19	920
.56	± 20%	40	25.0	280.0	.11	950	1.2	± 10%	50	7.9	144.0	.21	880
.68	± 20%	40	25.0	250.0	.12	900	1.5	± 10%	50	7.9	131.0	.23	830
.82	± 20%	40	25.0	200.0	.12	900	1.8	± 10%	55	7.9	121.0	.25	790
1.0	± 10%	50	25.0	180.0	.15	815	2.2	± 10%	55	7.9	110.0	.28	750
1.2	± 10%	50	7.9	165.0	.18	740	2.7	± 10%	60	7.9	100.0	.30	720
1.5	± 10%	50	7.9	150.0	.20	700	3.3	± 10%	65	7.9	94.0	.34	670
1.8	± 10%	50	7.9	125.0	.23	655	3.9	± 10%	65	7.9	86.0	.37	640
2.2	± 10%	50	7.9	115.0	.25	630	4.7	± 10%	70	7.9	80.0	.39	620
2.7	± 10%	50	7.9	100.0	.28	595	5.6	± 10%	70	7.9	74.0	.43	590
3.3	± 10%	50	7.9	90.0	.30	575	6.8	± 10%	75	7.9	68.0	.48	550
3.9	± 10%	50	7.9	80.0	.32	555	8.2	± 10%	80	7.9	53.0	.52	530
4.7	± 10%	50	7.9	75.0	.35	530	10.0	± 10%	85	7.9	45.0	.58	500
5.6	± 10%	50	7.9	65.0	.40	500	12.0	± 10%	75	2.5	42.0	.63	480
6.8	± 10%	50	7.9	60.0	.45	470	15.0	± 10%	70	2.5	40.0	.72	460
8.2	± 10%	50	7.9	55.0	.55	425	18.0	± 10%	65	2.5	34.0	.77	430
10.0	± 10%	50	7.9	50.0	.72	370	22.0	± 10%	60	2.5	30.0	.84	410
12.0	± 10%	50	2.5	40.0	.80	350	27.0	± 10%	55	2.5	25.0	.94	390
15.0	± 10%	50	2.5	35.0	.88	335	33.0	± 10%	55	2.5	19.0	1.03	370
18.0	± 10%	50	2.5	30.0	1.0	315	39.0	± 10%	50	2.5	14.5	1.12	350
22.0	± 10%	50	2.5	25.0	1.2	285	47.0	± 10%	45	2.5	13.0	1.22	340
27.0	± 10%	50	2.5	20.0	1.35	270	56.0	± 10%	40	2.5	12.0	1.34	320
33.0	± 10%	50	2.5	24.0	1.5	255		± 10%					
39.0	± 10%	50	2.5	22.0	1.7	240	68.0	± 10%	40 35	2.5	11.0	1.47	305
47.0	± 10%	60	2.5	20.0	2.3	205	82.0			2.5	10.3	1.62	290
56.0	± 10%	60	2.5	18.0	2.6	195	100.0	± 10%	30	2.5	9.5	1.8	275
68.0	± 10%	60	2.5	15.0	2.9	185	120.0	± 10%	70	.79	3.8	3.7	185
82.0	± 10%	60	2.5	14.0	3.2	175	150.0	± 10%	70	.79	3.5	4.2	175
100.0	± 10%	60	2.5	13.0	3.5	165	180.0	± 10%	70	.79	3.3	4.6	165
120.0	± 10%	60	.79	5.40	3.8	160	220.0	± 10%	70	.79	3.0	5.1	155
150.0	± 10%	60	.79	4.75	4.4	150	270.0	± 10%	70	.79	2.8	5.8	145
180.0	± 10%	60	.79	4.35	5.0	140	330.0	± 10%	70	.79	2.6	6.4	137
220.0	± 10%	60	.79	4.0	5.7	130	390.0	± 10%	65	.79	2.4	7.0	133
270.0	± 10%	60	.79	3.70	6.5	120	470.0	± 10%	65	.79	2.25	7.7	126
330.0	± 10%	60	.79	3.40	9.5	100	560.0	± 10%	65	.79	2.1	8.5	120
390.0	± 10%	60	.79	2.80	10.5	95	680.0	± 10%	65	.79	1.95	9.4	113
470.0	± 10%	60	.79	2.55	11.6	90	820.0	± 10%	65	.79	1.85	10.5	105
560.0	± 10%	60	.79	2.35	13.0	85	1000.0	± 10%	65	.79	1.4	14.0	100
680.0	± 10%	60	.79	2.0	18.0	75	* **		4.11.1-	all land			
820.0	± 10% ± 10%	60 60	.79 .79	1.85 1.40	23.0 26.0	65 60		ured with		gtn lead. ed on a temperati			The State of the S



How to Order & Test Equipment: Same as IR.

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ±5%, ±10%, ±20%. Other tolerances available on request. Insulation Resistance: 1000 M Ω min. per MIL-STD-202, Method 302, Test Condition B.

Operating Temperature Range: - 55°C to + 105°C.

MECHANICAL and ENVIRONMENTAL SPECIFICATIONS (Per MIL-STD-202)

Terminal Strength: 5 lbs. pull, Method 211, Test Condition A.

Flammability: Method 111.

Resistance to Soldering Heat: Method 210, Test Condition A.

Resistance to Solvents: Method 215. **MATERIAL SPECIFICATIONS**

Coating: Epoxy-uniform roll coated. Lead: Tinned Copper. Core: Ferrite.

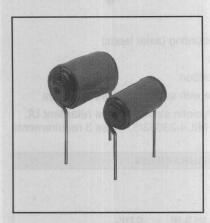
Weight: IRF-1 = .3 gram maximum. IRF-3 = .6 gram maximum.

ENVIRONMENTAL SPECIFICATIONS - Overload: Per MIL-C-15305.

MODEL IH Filter Inductors

High Current





FEATURES

- · Printed circuit mounting
- Pre-tinned leads
- Protected by polyolefin tubing flame retardant UL type VW-1 per MIL-I-23053/5, Class 3 requirements

APPLICATIONS

Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits.

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1.0 volt with zero DC current.

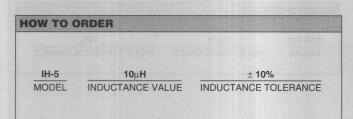
Incremental Current: The typical current at which the inductance will be

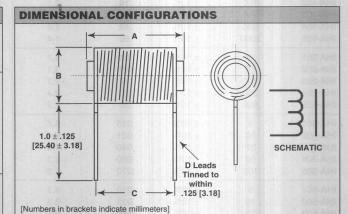
decreased by 5% from its initial zero DC value.

Operating Temperature: - 55°C to + 125°C (no load).

- 55°C to 75°C (at full rated current).

STAND	ARD ELEC	CTRICAL	SPECII	FICATIONS	
MODEL	IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Max. Amps)	INCRE- MENTAL CURRENT (Amps)
IH-3	5	± 10%	.015	10.0	25
IH-3	10	± 10%	.018	9.0	19
IH-3	27	± 10%	.035	7.0	12
IH-3	50	± 10%	.050	5.6	8
IH-3	100	± 10%	.065	5.2	6
IH-3	150	± 10%	.075	5.0	5
IH-3	250	± 10%	.090	5.0	4
IH-5	5	± 10%	.012	14.0	25
IH-5	10	± 10%	.015	12.0	19
IH-5	27	± 10%	.025	9.0	13
IH-5	50	± 10%	.030	8.0	10
IH-5	68	± 10%	.035	7.5	9
IH-5	100	± 10%	.050	7.5	7
IH-5	150	± 10%	.060	7.0	5
IH-10	5	± 10%	.010	19.0	25
IH-10	10	± 10%	.012	16.0	19
IH-10	27	± 10%	.018	12.5	12
IH-10	50	± 10%	.025	11.0	10
IH-10	68	± 10%	.027	10.0	8
IH-10	100	± 10%	.030	10.0	7
IH-15	5	± 10%	.008	24.0	25
IH-15	10	± 10%	.010	20.0	19
IH-15	27	± 10%	.015	16.0	14
IH-15	50	± 10%	.020	15.0	10



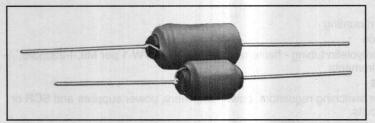


	Tarabitoto il laidato i			L CENTER
MODEL	A (Max.)	B (Max.)	C ± .062 [1.59]	D ± .005 [.130]
IH-3	.875 [22.23]	.600 [15.24]	.500 [12.70]	.042 [1.067]
IH-3	1.125 [28.58]	.625 [15.88]	.687 [17.45]	.042 [1.067]
IH-3	.875 [22.23]	.800 [20.32]	.437 [11.10]	.042 [1.067]
IH-3	.875 [22.23]	.800 [20.32]	.750 [19.05]	.042 [1.067]
IH-3	1.125 [28.58]	.800 [20.32]	.937 [23.80]	.042 [1.067]
IH-3	1.375 [34.93]	.800 [20.32]	1.062 [26.97]	.042 [1.067]
IH-3	1.625 [41.28]	.800 [20.32]	1.312 [33.32]	.042 [1.067]
IH-5	.875 [22.23]	.625 [15.88]	.750 [19.05]	.053 [1.35]
IH-5	1.125 [28.58]	.625 [15.88]	1.0 [25.40]	.053 [1.35]
IH-5	.875 [22.23]	.840 [21.34]	.562 [14.27]	.053 [1.35]
IH-5	1.125 [28.58]	.840 [21.34]	.750 [19.05]	.053 [1.35]
IH-5	1.125 [28.58]	.860 [21.84]	.875 [22.23]	.053 [1.35]
IH-5	1.375 [34.93]	.860 [21.84]	1.0 [25.40]	.053 [1.35]
IH-5	1.625 [41.28]	.860 [21.84]	1.250 [31.75]	.053 [1.35]
IH-10	1.125 [28.58]	.635 [16.13]	.812 [20.62]	.065 [1.65]
IH-10	1.375 [34.93]	.635 [16.13]	1.218 [30.94]	.065 [1.65]
IH-10	1.125 [28.58]	.935 [23.75]	.687 [17.45]	.065 [1.65]
IH-10	1.375 [34.93]	.935 [23.75]	.937 [23.80]	.065 [1.65]
IH-10	1.375 [34.93]	.935 [23.75]	1.125 [28.58]	.065 [1.65]
IH-10	1.625 [41.28]	.935 [23.75]	1.312 [33.32]	.065 [1.65]
IH-15	1.375 [34.93]	.700 [17.78]	.937 [23.80]	.082 [2.08]
IH-15	1.687 [42.85]	.700 [17.78]	1.50 [38.10]	.082 [2.08]
IH-15	1.375 [34.93]	1.0 [25.40]	.937 [23.80]	.082 [2.08]
IH-15	1.625 [41.28]	1.0 [25.40]	1.125 [28.58]	.082 [2.08]

MODEL IHA Filter Inductors

High Current





FEATURES

- Printed circuit mounting (axial leads)
- Pre-tinned leads
- · Low cost construction
- Designed for use with switching power supplies
- Protected by polyolefin sleeve flame retardant UL type VW-1 per MIL-I-23053/5, Class 3 requirements

STANDARD ELECTRICAL SPECIFICATIONS							
MODEL	IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Max. Amps)			
IHA-101	50	± 10%	.12	2.5			
IHA-102	100	± 10%	.16	2.1			
IHA-103	250	± 10%	.28	1.8			
IHA-104	500	± 10%	.42	1.6			
IHA-105	1000	± 10%	.60	1.4			
IHA-201	27	± 10%	.060	3.7			
IHA-202	50	± 10%	.085	3.1			
IHA-203	100	± 10%	.12	2.7			
IHA-204	250	± 10%	.20	2.4			
IHA-205	500	± 10%	.32	2.3			
IHA-301	5	± 10%	.015	6.8			
IHA-302	10	± 10%	.021	6.1			
IHA-303	27	± 10%	.040	4.8			
IHA-304	50	± 10%	.050	4.3			
IHA-305	100	± 10%	.070	4.2			
IHA-501	5	± 10%	.010	9.3			
IHA-502	10	± 10%	.015	8.3			
IHA-503	27	± 10%	.030	6.5			
IHA-504	50	± 10%	.040	6.1			
IHA-505	100	± 10%	.060	5.9			

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1 V with no DC current.

Current Rating: Maximum continuous operating current (DC or RMS) based on 50°C temperature rise.

Dielectric Rating: 2500 V RMS, 60 Hz, applied for one minute between winding and outer circumference to within .250" [6.35] of the insulation sleeve edge.

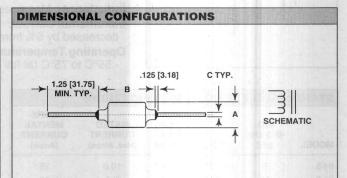
Operating Temperature: - 55°C to + 125°C (no load). - 55°C to + 75°C (at full rated current).

MECHANICAL SPECIFICATIONS

Winding: Layered solenoid type with magnetic core.

Wire: Solid soft copper.

Terminals: Tinned copper leads. **Coating:** Polyolefin tubing.



[Numbers in brackets indicate millimeters]

MODEL	A (Max.)	B (Max.)	C ± .002 [.050]
IHA-101	.475 [12.07]	.800 [20.32]	.032 [.813]
IHA-102	.475 [12.07]	.800 [20.32]	.032 [.813]
IHA-103	.475 [12.07]	1.05 [26.67]	.032 [.813]
IHA-104	.550 [13.97]	1.05 [26.67]	.032 [.813]
IHA-105	.550 [13.97]	.175 [29.85]	.032 [.813]
IHA-201	.500 [12.70]	.800 [20.32]	.032 [.813]
IHA-202	.500 [12.70]	.800 [20.32]	.032 [.813]
IHA-203	.500 [12.70]	.920 [23.37]	.032 [.813]
IHA-204	.600 [15.24]	.920 [23.37]	.032 [.813]
IHA-205	.750 [19.05]	1.05 [26.67]	.032 [.813]
IHA-301	.475 [12.07]	.800 [20.32]	.032 [.813]
IHA-302	.475 [12.07]	.920 [23.37]	.032 [.813]
IHA-303	.550 [13.97]	.800 [20.32]	.032 [.813]
IHA-304	.550 [13.97]	.920 [23.37]	.032 [.813]
IHA-305	.550 [13.97]	1.175 [29.85]	.032 [.813]
IHA-501	.475 [12.07]	1.05 [26.67]	.040 [1.02]
IHA-502	.475 [12.07]	1.05 [26.67]	.040 [1.02]
IHA-503	.700 [17.78]	1.05 [26.67]	.040 [1.02]
IHA-504	.700 [17.78]	1.05 [26.67]	.040 [1.02]
IHA-505	.700 [17.78]	1.30 [33.02]	.040 [1.02]

HOW TO C	RDER	
IHA-101	50 μH	± 10%
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE

		LELO	TRICAL S	PECIFIC					
MODEL	HD-1			The state of	MODEL	IHD-3			250116
IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Max. Amps)	INCRE- MENTAL CURRENT (Amps Approx.)	IND. @ 1 kHz (μH)		DCR MAX. (Ohms)	RATED CURRENT (Max. Amps)	INCRE- MENTAL CURRENT (Amps Approx.)
1.0 1.2	± 15% ± 15%		5.3 5.0	7.0 6.4	3.9 4.7	± 15% ± 15%	.007	4.0 4.0	8.2 7.5
1.5	± 15%	.011	4.8	5.7	5.6	± 15%	.011	4.0	6.9
	± 15%	.012	4.6	5.2	6.8	± 15%	.011	4.0	6.3
	± 15% ± 15%	.013	4.4	4.7	8.2 10.0	± 15% ± 15%	.013	4.0 4.0	5.7 5.2
2.7	± 15%		4.2	3.9	12.0	± 15%	.018	4.0	4.7
3.9	± 15%		3.8	3.6	15.0	± 15%	.020	4.0	4.3
4.7	± 15%		3.4	3.3	18.0	± 15%	.022	4.0	3.9
5.6	± 15%		3.2	3.0	22.0	± 15%	.024	4.0	3.5
6.8	± 15%		3.1	2.7	27.0	± 15%	.025	4.0	3.2
	± 15%	.028	3.0	2.5	33.0	± 15%	.028	4.0	2.9
10.0	± 15%	.033	2.8	2.3	39.0	± 15%	.031	4.0	2.7
12.0 15.0	± 15% ± 15%	.037	2.6	2.1	47.0 56.0	± 15% ± 15%	.034	4.0 3.2	2.5
The second secon	± 15%	.040	2.5	1.9	68.0	± 15%	.059	2.5	2.3
22.0	± 15%	.050	2.2	1.5	82.0	± 15%	.066	2.0	1.9
27.0	± 15%	.070	1.9	1.4	100.0	± 15%	.084	1.6	1.7
33.0	± 15%		1.8	1.3	120.0	± 15%	.113	1.6	1.6
39.0	± 15%		1.7	1.2	150.0	± 15%	.129	1.6	1.4
47.0	± 15%		1.6	1.1	180.0	± 15%	.150	1.6	1.3
56.0	± 15%		1.4	.97	220.0	± 15%	.162	1.6	1.2
68.0	± 15% ± 15%		1.3	.88	270.0	± 15%	.226	1.6	1.1
82.0 100.0	± 15%	.152	1.3 1.1	.80	330.0 390.0	± 15% ± 15%	.257	1.6 1.6	.95 .88
	± 15%		.94	.66	470.0	± 15%	.393	1.2	.80
	± 15%	.330	.87	.60		± 15%	.504	1.0	.74
180.0	± 15%	.362	.83	.54	680.0	± 15%	.570	1.0	.67
100000000000000000000000000000000000000	\pm 15%	.505	.70	.49	820.0	± 15%	.643	.80	.61
	± 15%	.557	.67	.45		± 15%	.844	.80	.56
	± 15%	0.5.5.5	.62	.40		± 15%	.977	.60	.51
390.0 470.0	± 15% ± 15%	.770 1.03	.57 .49	.37		± 15% ± 15%	1.18	.60	.46
560.0	± 15%	1.14	.49	.31		± 15%	1.76	.50	.38
680.0	± 15%	1.50	.41	.28		± 15%	2.13	.40	.34
820.0	± 15%	1.98	.36	.26		± 15%	2.53	.40	.31
1000.0	± 15%	2.30	.33	.23	3900.0	± 15%	2.84	.40	.29
	± 15%		.31	.21		± 15%	3.79	.40	.26
	± 15%	3.0	.29	.19		± 15%	4.24	.32	.24
	± 15%	4.0	.25	.18		± 15%	5.75	.25	.22
(A)	± 15% ± 15%	4.40 5.80	.24	.16	8200.0 10000.0		6.44 7.30	.25 .25	.20
	± 15%	6.56	.20	.13	12000.0		9.34	.20	.18
3900.0		8.63	.17	.13	15000.0		10.7	.20	.17
4700.0		10.1	.16	.11	18000.0		14.8	.16	.14
5600.0		11.2	.15	.10	22000.0		18.0	.13	.12
6800.0		15.0	.13	.09	27000.0	± 15%	22.7	.13	.11
8200.0			.11	.08	33000.0		25.7	.13	.10
10000.0			.10	.08	39000.0		29.7	.10	.09
12000.0			.10	.07	47000.0		33.7	.10	.09
15000.0			.08	.06	56000.0		38.0	.10	.08
18000.0	± 15%	40.0	.08	.06	68000.0 82000.0		52.8 67.3	.08 .07	.07
					02000.0	I 15%	0/.3	.0/	0/

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1 V with no

DC current.

Incremental Current: The typical current at which the inductance will be decreased by 5% from its initial zero DC value.

Dielectric Rating: 2500 V RMS between winding and outer circumference to within .250" [6.35] of the insulating sleeve edge.

Operating Temperature:

- 55°C to + 125°C (no load).
- 55°C to + 85°C (at full rated current).

MECHANICAL SPECIFICATIONS

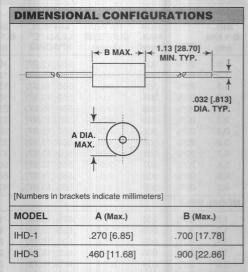
Wire: Solid soft copper.

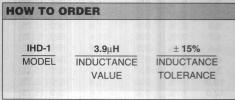
Terminals: 20 AWG tinned copper leads.

Coating: Polyolefin tubing - flame

retardant UL type VW-1 per MIL-I-23053/5,

Class 3 requirements.

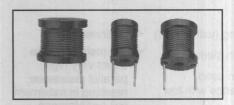




MODEL IHB Filter Inductors

High Current





FEATURES

- · Printed circuit mounting
- Wide range of inductance and current ratings
- Pre-tinned leads
- Optional insulating covering and printing available at additional cost

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1 V with no DC current.

Dielectric: 2500 V RMS between winding and .250" [6.35] of insulating covering edge (with optional insulating covering).

Operating Temperature: - 55°C to + 130°C (no load).

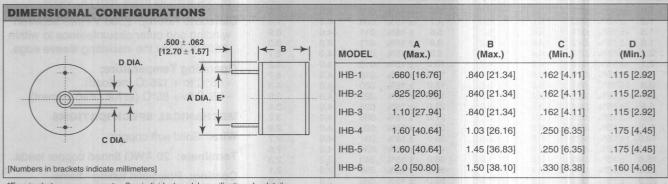
- 55°C to + 80°C (at full rated current).

MECHANICAL SPECIFICATIONS

Terminals: Extensions of winding wire, solder coated to

within .063" [1.60] of body.

Mounting: Center hole for mechanical mounting.



^{*}E varies between components. See individual model specifications for details.

MODEL	HB-1													
IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Amps)	APPROX. LEAD "E" SPACING	IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Amps)	APPROX. LEAD "E" SPACING	IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Amps)	APPROX. LEAD "E" SPACING
1.0	20%	.003	9.0	.550 [13.97]	10.0	10%	.010	9.0	.550 [13.97]	100.0	10%	.095	2.8	.500 [12.70]
1.2	20%	.003	9.0	.550 [13.97]	12.0	10%	.011	9.0	.550 [13.97]	120.0	10%	.127	2.0	.500 [12.70]
1.5	20%	.004	9.0	.550 [13.97]	15.0	10%	.015	7.2	.500 [12.70]	150.0	10%	.181	1.6	.500 [12.70]
1.8	20%	.004	9.0	.550 [13.97]	18.0	10%	.016	7.2	.500 [12.70]	180.0	10%	.217	1.6	.500 [12.70]
2.2	20%	.005	9.0	.550 [13.97]	22.0	10%	.020	5.5	.500 [12.70]	220.0	10%	.240	1.6	.500 [12.70]
2.7	20%	.005	9.0	.550 [13.97]	27.0	10%	.030	4.5	.500 [12.70]	270.0	10%	.300	1.6	.480 [12.19]
3.3	20%	.005	9.0	.550 [13.97]	33.0	10%	.040	4.0	.475 [12.07]	330.0	10%	.336	1.3	.480 [12.19]
3.9	20%	.006	9.0	.550 [13.97]	39.0	10%	.046	4.0	.475 [12.07]	390.0	10%	.460	1.0	.480 [12.19]
4.7	20%	.007	9.0	.550 [13.97]	47.0	10%	.062	2.8	.470 [11.94]	470.0	10%	.636	.8	.475 [12.07]
5.6	20%	.007	9.0	.550 [13.97]	56.0	10%	.069	2.8	.470 [11.94]	560.0	10%	.696	.8	.475 [12.07]
6.8	20%	.008	9.0	.550 [13.97]	68.0	10%	.077	2.8	.500 [12.70]					
8.2	20%	.009	9.0	.550 [13.97]	82.0	10%	.083	2.8	.500 [12.70]					
MODEL	IHB-2					AG: I-C	58	1 184 3	SEL HOUSE	THE REAL PROPERTY.		980		1 4 0.0007
1.0	20%	.003	11.4	.620 [15.75]	15.0	10%	.013	9.0	.620 [15.75]	220.0	10%	.150	2.8	.600 [15.24]
1.2	20%	.003	11.4	.620 [15.75]	18.0	10%	.018	7.2	.615 [15.62]	270.0	10%	.213	2.0	.600 [15.24]
1.5	20%	.003	11.4	.620 [15.75]	22.0	10%	.019	7.2	.615 [15.62]	330.0	10%	.305	1.6	.600 [15.24]
1.8	20%	.003	11.4	.620 [15.75]	27.0	10%	.026	5.5	.575 [14.61]	390.0	10%	.320	1.6	.600 [15.24]
2.2	20%	.004	11.4	.620 [15.75]	33.0	10%	.029	5.5	.575 [14.61]	470.0	10%	.355	1.6	.590 [14.99]
2.7	20%	.005	11.4	.620 [15.75]	39.0	10%	.030	5.5	.600 [15.24]	560.0	10%	.388	1.6	.590 [14.99]
3.3	20%	.005	11.4	.620 [15.75]	47.0	10%	.035	5.5	.600 [15.24]	680.0	10%	.430	1.6	.590 [14.99]
3.9	20%	.005	11.4	.620 [15.75]	56.0	10%	.039	5.5	.600 [15.24]	820.0	10%	.590	1.3	.590 [14.99]
4.7	20%	.005	11.4	.620 [15.75]	68.0	10%	.053	4.8	.600 [15.24]	1000.0	10%	.818	1.0	.590 [14.99]
5.6	20%	.006	11.4	.620 [15.75]	82.0	10%	.060	4.8	.600 [15.24]	1200.0	10%	1.14	.8	.590 [14.99]
6.8	20%	.007	11.4	.620 [15.75]	100.0	10%	.080	4.0	.600 [15.24]	1500.0	10%	1.26	.8	.590 [14.99]
8.2	20%	.007	11.4	.620 [15.75]	120.0	10%	.090	4.0	.600 [15.24]	1800.0	10%	1.39	.8	.590 [14.99]
10.0	10%	.009	11.4	.620 [15.75]	150.0	10%	.098	4.0	.600 [15.24]	2200.0	10%	1.54	.8	.590 [14.99]
12.0	10%	.009	11.4	.620 [15.75]	180.0	10%	.110	4.0	.600 [15.24]					

MODEL IHB

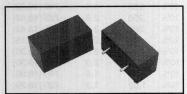
		ELEC	TRICAL S	PECIFICA.	HONS a	ind D	INENS	NOW E [M	umbers in b	I denets	Madel	C manual		
MODEL I	НВ-3	DCD	DATED	ADDDOV	IND		DCR	RATED	APPROX.	IND.		DCR	RATED	APPROX
IND. ② 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Amps)	APPROX. LEAD "E" SPACING	IND. @ 1 kHz (μH)	TOL.	MAX. (Ohms)	CURRENT (Amps)	LEAD "E" SPACING	@ 1 kHz (μH)	TOL.	MAX. (Ohms)	CURRENT (Amps)	LEAD "E' SPACING
1.0	20%	.003	21.0	.790 [20.07]	18.0	10%	.010	13.5	.750 [19.05]	330.0	10%	.122	4.5	.770 [19.56
1.2	20%	.003	21.0	.790 [20.07]	22.0	10%	.011	13.5	.750 [19.05]	390.0	10%	.169	4.0 4.0	.740 [18.80 .740 [18.80
1.5	20%	.003	21.0	.790 [20.07]	27.0	10%	.012	13.5	.800 [20.32]	470.0 560.0	10%	.205	4.0	.740 [18.86
1.8	20%	.003	21.0	.790 [20.07]	33.0	10%	.017	13.5	.780 [19.81]	680.0	10%	.256	2.8	.725 [18.4
2.2	20%	.003	21.0	.790 [20.07]	39.0	10%	.022	11.4 9.0	.780 [19.81] .760 [19.30]	820.0	10%	.288	2.8	.725 [18.4
2.7	20%	.003	21.0	.790 [20.07]	47.0 56.0	10%	.024	9.0	.760 [19.30]	1000.0	10%	.426	2.0	.715 [18.1
3.3	20%	.003	21.0 21.0	.790 [20.07] .790 [20.07]	68.0	10%	.029	9.0	.760 [19.30]	1200.0	10%	.462	2.0	.760 [19.3
3.9 4.7	20%	.003	21.0	.790 [20.07]	82.0	10%	.032	9.0	.760 [19.30]	1500.0	10%	.518	2.0	.760 [19.3
5.6	20%	.003	21.0	.790 [20.07]	100.0	10%	.034	9.0	.760 [19.30]	1800.0	10%	.705	1.6	.740 [18.8
6.8	20%	.004	21.0	.790 [20.07]	120.0	10%	.046	7.2	.740 [18.80]	2200.0	10%	1.02	1.3	.720 [18.2
8.2	20%	.004	21.0	.790 [20.07]	150.0	10%	.064	5.5	.720 [18.29]	2700.0	10%	1.14	1.3	.720 [18.2
10.0	10%	.006	17.0	.770 [19.56]	180.0	10%	.072	5.5	.720 [18.29]	3300.0	10%	1.27	1.3	.720 [18.2
12.0	10%	.008	13.5	.750 [19.05]	220.0	10%	.080	5.5	.790 [20.07]	3900.0	10%	1.67	1.0	.700 [17.7
15.0	10%	.009	13.5	.750 [19.05]	270.0	10%	.110	4.5	.770 [19.56]	4700.0	10%	1.86	1.0	.730 [18.5
MODEL	IHB-4			i Milian				Other Court of	Tiest					239/A
1.8	20%	.002	27.0	1.10 [27.94]	39.0	10%	.012	21.0	1.10 [27.94]	820.0	10%	.154	7.2	1.13 [28.7
2.2	20%	.002	27.0	1.10 [27.94]	47.0	10%	.018	14.4	1.10 [27.94]	1000.0	10%	.216	5.5 5.5	1.10 [27.9 1.10 [27.9
2.7	20%	.003	27.0	1.10 [27.94]	56.0	10%	.019	14.4	1.11 [28.19]	1200.0	10%		4.5	
3.3	20%	.003	27.0	1.10 [27.94] 1.10 [27.94]	68.0 82.0	10%	.021	14.4 14.4	1.11 [28.19] 1.11 [28.19]	1500.0	10%	.324	4.5	1.14 [28.9 1.14 [28.9
3.9	20%	.003	27.0 27.0	1.10 [27.94]	100.0	10%	.025	14.4	1.11 [28.19]	2200.0	10%	.494	4.0	1.11 [28.
4.7 5.6	20%	.003	27.0	1.10 [27.94]	120.0	10%	.028	14.4	1.11 [28.19]	2700.0	10%	.555	4.0	1.11 [28.
6.8	20%	.004	27.0	1.10 [27.94]	150.0	10%	.040	11.4	1.10 [27.94]	3300.0	10%	.773	2.8	1.09 [27.0
8.2	20%	.004	27.0	1.10 [27.94]	180.0	10%	.045	11.4	1.10 [27.94]	3900.0	10%	.845	2.8	1.09 27.6
10.0	10%	.005	27.0	1.10 [27.94]	220.0	10%	.050	11.4	1.10 [27.94]	4700.0	10%	1.14	2.0	1.07 [27.
12.0	10%	.005	27.0	1.10 [27.94]	270.0	10%	.056	11.4	1.10 [27.94]	5600.0	10%	1.60	2.0	1.05 [26.6
15.0	10%	.006	27.0	1.10 [27.94]	330.0	10%	.074	11.4	1.16 [29.46]	6800.0	10%	1.76	1.6	1.05 [26.6
18.0	10%	.008	27.0	1.10 [27.94]	390.0	10%	.082	9.0	1.13 [28.70]	8200.0	10%	1.95	1.6	1.09 [27.6
22.0	10%	.009	21.0	1.10 [27.94]	470.0	10%	.114	7.2	1.13 [28.70]	10000.0	10%	2.76	1.3	1.07 [27.1
27.0	10%	.010	21.0	1.10 [27.94]	560.0	10%	.125	7.2	1.13 [28.70]	12000.0	10%	3.04	1.3	1.07 [27.1
33.0	10%	.011	21.0	1.10 [27.94]	680.0	10%	.139	7.2	1.13 [28.70]	15000.0	10%	3.39	1.3	1.07 [27.1
MODEL	IHB-5													0.85
1.8	20%	.002	35.0	1.13 [28.70]	39.0	10%	.010	27.0	1.10 [27.94]	820.0	10%	.127	9.0	1.07 [27.
2.2	20%	.002	35.0	1.13 [28.70]	47.0	10%		27.0	1.10 [27.94]	1000.0	10%	.176	7.2	1.05 [26.0
2.7	20%	.002	35.0	1.13 [28.70]	56.0	10%		21.0	1.10 [27.94]	1200.0	10%	.195	7.2	1.05 [26.0
3.3	20%	.002	35.0	1.13 [28.70]	68.0	10%	.015	21.0 21.0	1.10 [27.94] 1.10 [27.94]	1500.0	10% 10%	.274	5.5 5.5	1.03 [26. 1.10 [27.
3.9	20%	.003	35.0 35.0	1.13 [28.70] 1.13 [28.70]	82.0	10%	.017	21.0	1.10 [27.94]	2200.0	10%	.338	5.5	1.10 [27.
4.7 5.6	20%	.003	35.0	1.13 [28.70]	120.0	10%		17.0	1.08 [27.43]	2700.0	10%	.459	4.5	1.08 [27.4
6.8	20%	.003	35.0	1.13 [28.70]	150.0	10%		17.0	1.08 [27.43]	3300.0	10%	.642	4.0	1.06 [26.9
8.2	20%	.003	35.0	1.13 [28.70]	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10%		13.5	1.12 [28.45]	3900.0	10%	.699	4.0	1.06 [26.
10.0	10%	.004	35.0	1.13 [28.70]		10%		13.5	1.12 [28.45]	4700.0	10%	.775	4.0	1.06 [26.9
12.0	10%	.004	35.0	1.13 [28.70]	The second secon	10%		13.5	1.12 [28.45]	5600.0	10%	.843	4.0	1.06 [26.9
15.0	10%	.005	35.0	1.13 [28.70]	330.0	10%		13.5	1.12 [28.45]	6800.0	10%	1.15	2.8	1.04 [26.4
18.0	10%	.007	27.0	1.10 [27.94]	390.0	10%		11.4	1.09 [27.69]	8200.0	10%	1.26	2.8	1.09 [27.
22.0	10%	.007	27.0	1.10 [27.94]		10%		11.4	1.09 [27.69]	10000.0	10%	1.74	2.0	1.07 [27.
27.0	10%	.008	27.0	1.10 [27.94]		10%		9.0	1.07 [27.18]	12000.0	10%	1.92	2.0	1.07 [27.
33.0 MODEL	10% IHB-6	.009	27.0	1.10 [27.94]	680.0	10%	.115	9.0	1.07 [27.18]	15000.0	10%	2.17	2.0	1.07 [27.1
4.7	20%	.002	35.0	1.43 [36.32]	120.0	10%	.015	27.0	1.45 [36.83]	3300.0	10%	.498	4.5	1.32 [33.5
5.6	20%	.002	35.0	1.43 [36.32]		10%		21.0	1.43 [35.81]	3900.0	10%	.548	4.5	1.32 [33.
6.8	20%	.003	35.0	1.43 [36.32]		10%		21.0	1.41 [35.81]	4700.0	10%	.608	4.5	1.32 [33.
8.2	20%	.003	35.0	1.43 [36.32]		10%		21.0	1.41 [35.81]	5600.0	10%	.671	4.5	1.38 [35.
10.0	10%	.003	35.0	1.43 [36.32]		10%		21.0	1.41 [35.81]	6800.0	10%	.750	4.5	1.38 [35.
12.0	10%	.004	35.0	1.43 [36.32]	330.0	10%	.040	17.0	1.38 [35.05]	8200.0	10%	1.03	4.0	1.35 [34.
15.0	10%	.004	35.0	1.43 [36.32]		10%		13.5	1.35 [34.29]	10000.0	10%	1.16	4.0	1.35 [34.
18.0	10%	.005	35.0	1.43 [36.32]		10%		13.5	1.35 [34.29]	12000.0	10%	1.54	2.8	1.33 [33.
22.0	10%	.005	35.0	1.43 [36.32]		10%		13.5	1.35 [34.29]	15000.0	10%	1.75	2.8	1.33 [33.
	10%	.006	35.0	1.43 [36.32]		10%		11.4	1.33 [33.78]	18000.0	10%	1.94	2.8	1.38 [35.
27.0	10%	.006	35.0	1.43 [36.32]		10%		11.4	1.33 [33.78]	22000.0	10%	2.74	2.0	1.36 [34.
33.0	- 17-12-11	.006	35.0	1.43 [36.32]	1000.0	10%		9.0	1.31 [33.27]	27000.0	10%	3.71	1.7	1.33 [33.
33.0 39.0	10%				and the second second									
33.0 39.0 47.0	10%	.008	35.0	1.53 [36.86]		10%		9.0	1.40 [35.56]	33000.0	10%	4.16	1.7	
33.0 39.0 47.0 56.0	10% 10%	.008	35.0 35.0	1.53 [36.86] 1.53 [38.86]	1500.0	10%	.219	7.2	1.37 [34.80]	39000.0	10%	5.55	1.4	1.33 [33.
33.0 39.0 47.0	10%	.008	35.0	1.53 [36.86]	1500.0 1800.0		.219							

HOW TO ORDER		
IHB-1	10μΗ	± 10%
MODEL	INDUCTANCE VALUE	INDUCTANCE TOLERANCE

MODEL IHM-2 Filter Inductors

High Current





FEATURES

- Totally encapsulated using a potted flame-resistant shell
- Pre-tinned leads
- Printed circuit mounting

		10%	ologe ji jesteli
STANDAR	D ELECTRI	CAL SPECI	FICATIONS
IND. @ 1 kHz (μH)	TOL.	DCR MAX. (Ohms)	RATED CURRENT (Max. Amps)
1.0	± 10%	.005	17.8
1.2	± 10%	.005	17.0
1.5	± 10%	.006	16.2
1.8	± 10%	.006	15.6
2.2	± 10%	.007	15.0
2.7	± 10%	.008	14.5
3.3	± 10% + 10%	.008	14.0 13.5
3.9	± 10% ± 10%	.009	13.5
5.6		.010	12.75
6.8	1070	.012	12.50
8.2		.013	11.25
10.0	± 10%	.014	10.0
12.0		.016	9.25
15.0	± 10%	.022	8.50
18.0	± 10%	.024	7.50
22.0	± 10%	.033	6.50
27.0	± 10%	.037	6.0
33.0			5.50
39.0	± 10%	.056	5.0
47.0	± 10%	.076	4.50
56.0	± 10%	.084	4.25
68.0	± 10%	.093	4.0
82.0 100.0	± 10% ± 10%	.103	3.65 3.30
120.0	± 10% ± 10%	.140	3.0
150.0	± 10%	.210	2.70
180.0	± 10%	.241	2.45
220.0	± 10%	.330	2 20
270.0	± 10%	.420	1.95
330.0	± 10%	.510	1.70
390.0	± 10%	.561	1.65
470.0	± 10%	.610	1.60
560.0	± 10%	.687	1.45
680.0	± 10%	.910	1.30
820.0	± 10%	1.03	1.15
1000.0	± 10%	1.40	1.0
1200.0	± 10%	1.57	.92
1500.0 1800.0	± 10% ± 10%	2.20	.84 .77
2200.0	± 10% ± 10%	3.30	.69
2700.0	+ 10%	3.72	.62
3300.0	± 10%	5.10	.55
3900.0	± 10%	5.58	.50
4700.0	± 10%	7.70	.45
5600.0	± 10%	8.32	.41
6800.0	± 10%	11.70	.36
8200.0	± 10%	12.80	.35
10000.0	± 10%	14.20	.33
12000.0	± 10%	15.70	.30
15000.0	± 10%	21.90	.26

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1 V with no DC current.

Current Rating: Maximum continuous operating current based on

50°C temperature rise.

Dielectric Rating: 1500 V RMS between windings and top of

component.

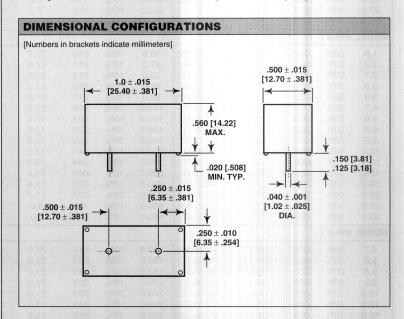
Operating Temperature: - 55°C to + 125°C (no load).

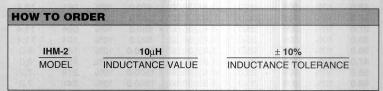
- 55°C to + 75°C (at full rated current).

MECHANICAL SPECIFICATIONS

Terminals: 18 AWG tinned copper.

Encapsulant: Flame-resistant shell potted with epoxy.





STANDARD ELECTRICAL SPECIFICATIONS SELF-DCR RATED RESONANT IND.* FREQ. MIN. MAX. CURRENT @ 1 kHz MODEL (µH) TOL. (kHz) (Ohms) (Max. Amps) IHV-15-500 500 ± 10% .8 .0500 15 IHV-20-200 200 ± 10% 1.2 .0210 20 IHV-28-60 60 ± 10% 1.9 .0085 28 30 IHV-30-150 ± 10% 2.1 .0130 150 IHV-40-39 39 ± 10% 2.5 .0048 40 IHV-45-92 2.9 92 ± 10% .0075 45 IHV-50-50 50 ± 10% 3.1 .0045 50 60 IHV-60-24 24 ± 10% 5.7 .0025

ELECTRICAL SPECIFICATIONS

Inductance: Measured at 1 V with no DC current.

Dielectric: 2500 V RMS between winding and outer circumference to within .250" [6.35] of the insulation sleeve

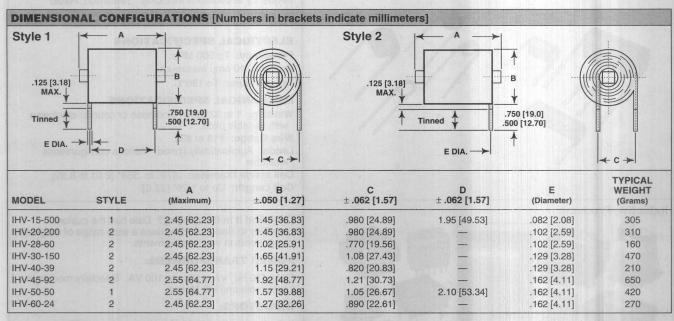
edge.

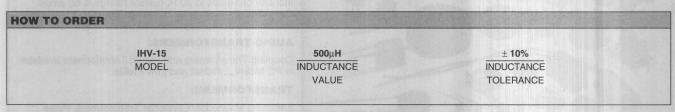
Operating Temperature: - 55°C to + 125°C (no load). Storage: - 55°C to + 75°C (at full rated current).

MECHANICAL SPECIFICATIONS

Terminals: Extensions of winding wire, solder coated.

Coating: Epoxy conformal coated.



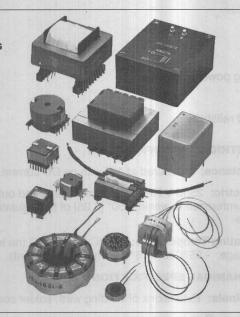


^{*} Will not decrease more than 10% at rated current.

CUSTOM PRODUCTS Magnetic Components







CUSTOM DESIGN AND PRODUCTION

Dale® has extensive facilities for custom design and production of custom magnetics used in switching power supplies including:

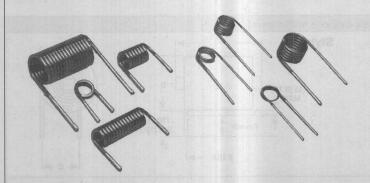
- Inductors
- Switching Converters
- Current Sense Transformers
- Power Transformers

PACKAGE DESIGN AND MATERIALS

If you have your own electrical design we can add value by assisting you with selection of the most economical materials and efficient packaging design.

Dale can provide designs to meet UL, CSA, IEEE and VDE requirements.

Air Core Inductors



Produced to your specifications for a wide range of high frequency applications including: Television, Radio (2-way, scanners, AM/FM), Satellite Communication, Cable TV Systems, Microwave, Test Equipment.

ELECTRICAL SPECIFICATIONS

Frequency: To 500 MHz. **Current:** 10 amp maximum. **Temperature:** To 130°C.

MECHANICAL SPECIFICATIONS

Winding: 1 to 32 turns, clockwise or counter-clockwise

with variable pitch.

Wire Gauge: #18 to #32.

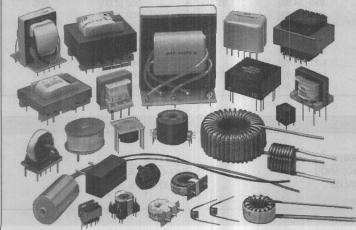
Leads: Automatically tinned. Various configurations

available.

Coil Inside Diameter: .079" to .354" [2.01 to 8.99].

Coil Length: Up to 1.26" [32.0].

Inductive Products



Can't find it in the catalog? Dale has the custom capability to design and produce a wide range of magnetic components to your requirements.

POWER TRANSFORMERS:

50 to 400 Hz, VA ratings to 100 VA. Specialty models in Low Profile and PC Mount.

INDUCTORS:

Inductance values to 20 H, current ratings to 60 amps. Capability of many styles including: Toroidal, Laminated, E Core, Pot Core, Slug Core, Air Core.

AUDIO TRANSFORMERS:

Coupling Transformers and Hybrid Transformers available in PC Mount, Leadset and Low Profile.

TRANSFORMERS:

Switching Magnetics, Converter Transformers, Pulse Transformers, High Voltage Transformer.

SURFACE MOUNT Inductive Components Quick Reference Guide





STANDARD PRODUCTS	S	
1. 3 0	MODELS IS-21 and IS-22 Inductors Toroidal or Pot Core 100μH to 40,000μH	Molded shell design. High Q. Low EMI. EIA PDP-100 P/N SOPM6464 package. Pick and place compatible.
2.	MODEL PT-100-09 Transformers ISDN S/T and U Interfaces	CCITT I.430 pulse wave form. Digital communications. Pulse coupling. Pick and place compatible.
3.	MODEL IMC-1812 Inductors Molded Chips 0.01μH to 1,000μH	RF circuits. Rugged construction. Size is .177" [4.50] L x .126" [3.20] W x .126" [3.20] H. Pick and place compatible.
4.	MODEL ISC-1812 Inductors Shielded Molded Chips 0.1μH to 1,000μH	RF circuits. Rugged construction. Size is .177" [4.50] L x .126" [3.20] W x .126" [3.20] H. Pick and place compatible.
5.	MODEL IMC-1210 Inductors Molded Chips 0.01μH to 100μH	RF circuits. Rugged construction. Size is .126" [3.20] L x .098" [2.49] W x .087" [2.21] H. Pick and place compatible.

CUSTOM VARIATIONS OF STANDARD PRODUCTS						
6.	Toroid or Pot Core Inductors and Transformers, Slug Core Inductors	Modification of IS-21 and IS-22. Ferrite, molypermalloy, and powdered iron cores. Pick and place compatible.				

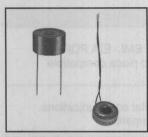
CUSTOM PRODUCTS		
7.	Toroidal Type Inductors or Transformers	Low Cost. Low EMI. Sizes down to 0.10" [2.54] OD.
8.	Slug Core Style Inductors	Low Cost. Large D-C current capability.
9.	LP Series Inductors or Transformers	Multiple sizes. On-board power supplies. Industry interchangeable. Pick and place compatible.

PRODUCTS UNDER DEVELOPMENT								
10.	Toroidal Type Inductors or Transformers Molded Construction	Modified C style solder pads. Switching regulators. Common mode chokes. Rugged construction. Pick and place compatible.						
11.	Ferrite Core Inductors Metalized Solder Pads	Ultra low profile. Very high inductance. Shielded. Low EMI. Pick and place compatible.						
12.	Ferrite Cup Core Inductors or Transformers	Shielded. Low EMI. Large D-C current capability. Low cost. Pick and place compatible.						

MODELS TE and TD Filter Inductors







FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TD style combines low cost with excellent performance in commercial applications
- High Q and wide selection of Q versus frequency ranges in one small package. Large number of standard inductance values.

STAND	DARD ELE	CTRICAL S	SPECIFICA	ATIONS (Ap	oplies to Core Only)				
MODEL		ora Pisterio del Cara de la compansión de la compa		pubak Selatak	T. C. AVAILABILITY				
TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5	T. C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	Q0	Q3	Q4
X	X	X	X	TA	0 ± 1%	- 55°C to + 125°C		X	X
		X	X	TB	0 ± 0.1%	+ 13°C to + 35°C		X	X
X	X	X	X	TD	0 ± 0.1%	0°C to + 55°C		X	X
		X	X	TE	0 ± 0.15%	0°C to + 55°C			X
4-11	X	X	X	TL*	+ 40 to + 110 PPM/°C + 85 to + 185 PPM/°C	- 55°C to + 25°C + 25°C to + 85°C			X
X	X	X	X	TM	0 ± 0.25%	- 65°C to + 125°C		Χ	X
X	X	Χ	X	TR	50 PPM/°C (Typical)	- 65°C to + 125°C	X		
X	X	X	X	TW	0 ± 0.25%	- 55°C to + 85°C		Χ	X

^{*} Inverse of typical Temperature Coefficient of polystyrene capacitor.

INDUCTANCE RANGES								
T. C. CODE	TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5				
Q0	40μH to 15mH	50μH to 15mH	150μH to 20mH	1mH to 100mH				
Q3	475μH to 120mH	500μH to 1H	1mH to 2H	5mH to 2H				
Q4	1mH to 250mH	1mH to 4H	2mH to 5H	10mH to 5H				

ELECTRICAL SPECIFICATIONS

Tolerance:

TE-2, TD-2 = \pm 1% > 2mH, \pm 2% = .05mH to 2mH.

TE-3, TD-3 = \pm 1% > 2mH, \pm 2% 154 μ H to 2mH, \pm 5% < 150 μ H.

TE-4, TD-4 = \pm 1% > 2mH, \pm 2% < 2mH. TE-5, TD-5 = \pm 1% > 2mH, \pm 2% < 2mH.

Insulation Resistance: 1000 Megohm minimum.

Dielectric Strength: 1000 V minimum (TE). 500 V minimum (TD).

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pounds pull test (TE).

Vibration: Per MIL-T-27 (TE).

Shock: Per MIL-T-27 (TE).

Weight: TE-2 = 2 grams, TD-2 = 1.6 grams typical.

TE-3 = 5.1 grams, TD-3 = 4.9 grams typical.

TE-4 = 20 grams, TD-4 = 17 grams typical.

TE-5 = 53 grams, TD-5 = 52 grams typical.

MATERIAL SPECIFICATIONS

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

Standard Terminals: Tinned copper (TE);
Stranded, tinned copper, Teflon insulated (TD).

Encapsulant: Epoxy (TE).

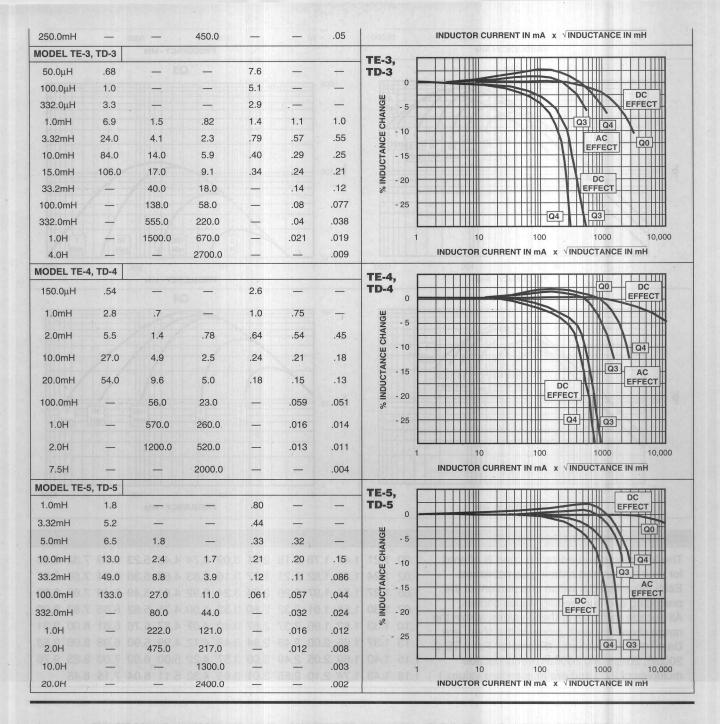
Gauge: TE-2 = 24 AWG, TD-2 = 30 AWG.

TE-3 = 22 AWG, TD-3 = 26 AWG.

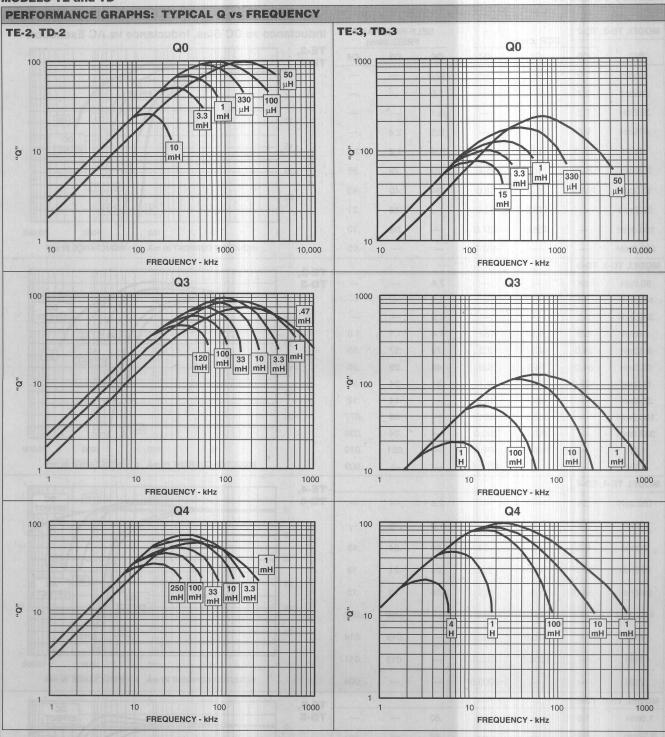
TE-4 = 20 AWG, TD-4 = 24 AWG.

TE-5 = 20 AWG, TD-5 = 24 AWG.

TE A F		MODEL	Α	В	C	D	E	F	G
A DIA. MAX.	\$ G	TE-2	.437 [11.10]	.270 [6.86]	1.0 [25.40]	.020 [.508]	.300 [7.62]	-	0
¥ ±		TD-2	.437 [11.10]	.250 [6.35]	2.0 [50.80]				_
← B → ←		TE-3	.685 [17.40]	.385 [9.78]	1.0 [25.40]	.025 [.635]	.500 [12.70]	.093 [2.36]	.250 [6.35]
TD and the same of	+	TD-3	.685 [17.40]	.320 [8.13]	3.0 [76.20]			.125 [3.18]	
СМІ	.375 ± .125 [9.53 ± 3.18]	TE-4	1.06 [26.92]	.500 [12.70]	1.0 [25.40]	.032 [.813]	.900 [22.86]	.120 [3.05]	.450 [11.43]
↑		TD-4	1.06 [26.92]	.437 [11.10]	4.0 [101.60]			.220 [5.59]	-8
A DIA. MAX	()	TE-5	1.32 [33.53]	.725 [18.42]	1.0 [25.40]	.032 [.813]	1.0 [25.40]	.144 [3.66]	.500 [12.70]
B MAX. DIA.	\sim	TD-5	1.32 [33.53]	.688	6.0 [152.40]			.220 [5.59]	



MODELS TE and TD



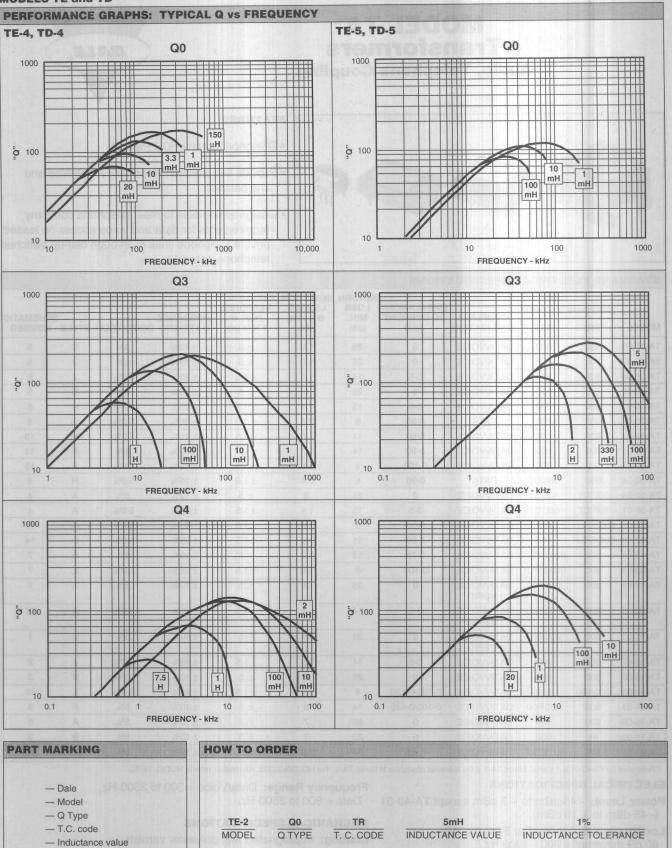
STANDARD INDUCTANCE VALUE

The following standardization chart is offered for your design and ordering convenience. Each value listed is within one percent of the preceding and succeeding values shown. All decade multiples of these values, within the range shown for each model in the chart, are Dale® standard values. (Example: For a TE-2 200µH, 20mH and 200mH are all decade multiples of 2.00 and are all standard values.)

1.00 1.21 1.47 1.78 2.15 2.61 3.09 3.74 4.42 5.23 6.19 7.32 8.66 1.02 1.24 1.50 1.82 2.21 2.67 3.16 3.83 4.53 5.36 6.34 7.50 8.87 1.05 1.27 1.54 1.87 2.26 2.74 3.24 3.92 4.64 5.49 6.49 7.68 9.00 1.07 1.30 1.58 1.91 2.32 2.80 3.32 4.00 4.75 5.62 6.65 7.87 9.09 1.10 1.33 1.62 1.96 2.37 2.87 3.40 4.02 4.87 5.76 6.81 8.00 9.31 1.13 1.37 1.65 2.00 2.43 2.94 3.48 4.12 4.99 5.90 6.98 8.06 9.53 1.15 1.40 1.69 2.05 2.49 3.00 3.57 4.22 5.00 6.00 7.00 8.25 9.76 1.18 1.43 1.74 2.10 2.55 3.01 3.65 4.32 5.11 6.04 7.15 8.45

MODELS TE and TD

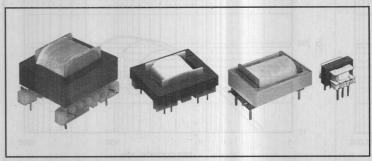
Inductance toleranceDate code



MODEL TA Transformers

Audio, Telephone Coupling





FEATURES

- Designed to meet FCC Part 68
- Provide line isolation, impedance matching and line balance
- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through dial-up switched telephone networks

	IMPEDAN	CE (Ohms)	COUPLING	UNBALANCED DC CURRENT		INSERTION LOSSES @ 1 kHz	FREQUENCY RESPONSE REF. @	IMPEDANCE			SCHEMATIC
MODEL	PRI	SEC	APPLICATION	(mA)	(dB)	(dB)	1 kHz (dB)		DISTORTION	STYLE	NUMBER
TA-10-08	600	600	DATA/VOICE	0	26	1.0	± .5	± 10%	.5%	С	5
TA-10-07	600	600	DATA/VOICE	0	26	1.0	± .5	± 10%	.5%	J	5
TA-30-06	600	600	DATA/VOICE	0-5	14	1.5	± 1.5	± 25%	5.0%	J	5
TA-10-05	600	600	DATA/VOICE	0	26	.6	± .5	± 10%	.5%	В	5
TA-30-02	600	600	DATA/VOICE	0-5	15	1.4	± 1.5	± 25%	5.0%	В	5
TA-30-03	600	600	DATA	0-90	8	2.4	± 1.0	± 25%	5.0%	G	5
TA-32-02	600	600	DATA/VOICE	0-80	11	1.2	± 1.5	± 25%	5.0%	М	13
TA-40-01*	600	600	DATA/VOICE	0-90	14	1.7	± 2.0	± 20%	.5%	N	13
TA-33-02	600	600	DATA/VOICE	0-100	8	1.6	± 1.5	± 25%	5.0%	E	15
TA-30-04	600	600 CT	DATA	0-90	8	2.4	± 1.0	± 25%	5.0%	Н	9
TA-10-04	600 CT	600 CT	DATA/VOICE	0	26	.6	± .5	± 10%	.5%	Α	4
TA-30-01	600 CT	600 CT	DATA/VOICE	0-5	15	1.4	± 1.5	± 25%	5.0%	Α	4
TA-31-01	600 SPLIT	600	DATA/VOICE	0-50	8	1.4	± 1.5	± 25%	5.0%	K	11
TA-32-03	600 SPLIT	600	DATA/VOICE	0-80	11	1.2	± 1.5	± 25%	5.0%	L	14
TA-13-01	600	600 SPLIT	DATA/VOICE	0-75	13	1.2	± .5	± 10%	.5%	E	7
TA-33-01	600	600 SPLIT	DATA/VOICE	0-100	8	1.6	± 1.5	± 25%	5.0%	E	7
TA-10-01	600	600/600	DATA/VOICE HYBRID	0	26	.8	± .5	± 10%	.5%	Α	1
TA-30-05	600	600/600	DATA/VOICE HYBRID	0-5	14	1.4	± 1.5	± 25%	5.0%	Α	10
TA-11-01	600	600/600	DATA/VOICE HYBRID	0	26	.8	± .5	± 10%	.5%	D	1
TA-30-07	600	900	DATA/VOICE	0-5	14	1.5	± 1.5	± 25%	5.0%	J	2
TA-10-02	600	900	DATA/VOICE	0	26	.7	± .5	± 10%	.5%	В	2
TA-32-01	600/900	600	DATA/VOICE	0-100/0-120	8	1.4	± 1.5	± 25%	5.0%	L	12
TA-14-01	600	600/900	DATA/VOICE	0-100/0-120	14	.5	± .5	± 10%	.5%	F	8
TA-10-06	900	900	DATA/VOICE	0	26	.7	± .5	± 10%	.5%	Α	6
TA-10-03	4k	600	DATA/VOICE	0	22	.7	±.5	± 10%	.5%	В	3
TA-23-01	600	600 SPLIT	DATA/VOICE	0-75	13	1.2	± .5	± 10%	.5%	E	16

^{*} Reference for TA-40-01 is 1.8 kHz. Model TA-3 is the low-cost alternative to Model TA-1. For HOLDING COIL information, refer to MODEL TE/TD.

ELECTRICAL SPECFICATIONS

Power Level: - 45 dBm to + 7 dBm except TA-40-01

(-45 dBm to + 10 dBm).

Longitudinal Balance: Per FCC 68.310 60 dB minimum = 200 - 1000 Hz. 45 dB minimum = 1000 - 4000 Hz.

Dielectric Strength: Per FCC 68.304 1500 V peak.

Frequency Range: Data/Voice = 300 to 3500 Hz.

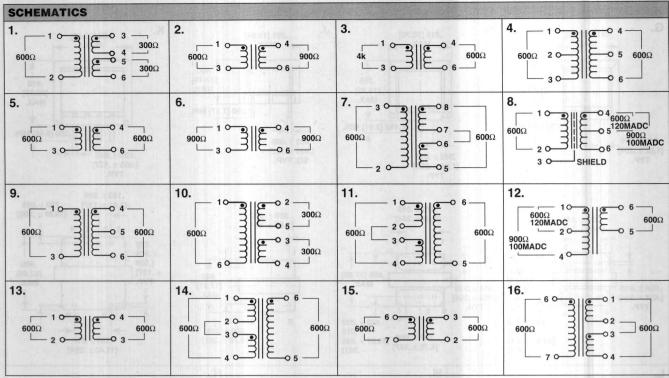
Data = 800 to 3500 Hz.

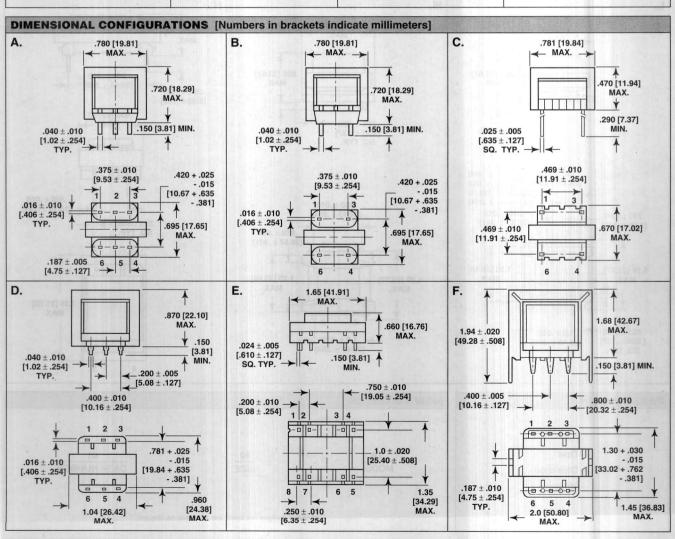
MECHANICAL SPECIFICATIONS

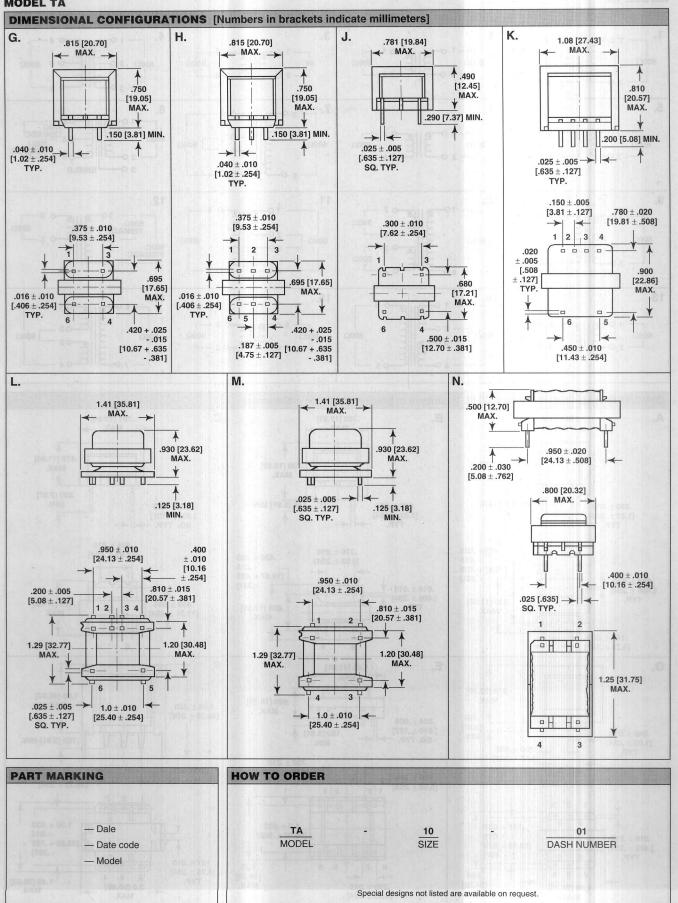
Coating: Impregnated with polyester varnish.

Terminals: Precision spaced PC type plug-in terminals.

MODEL TA





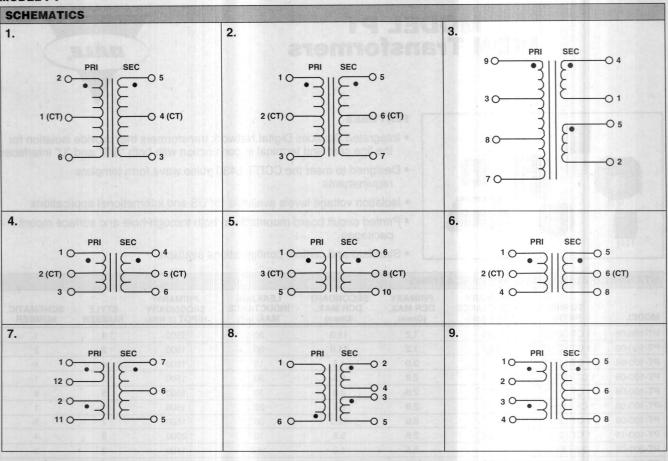


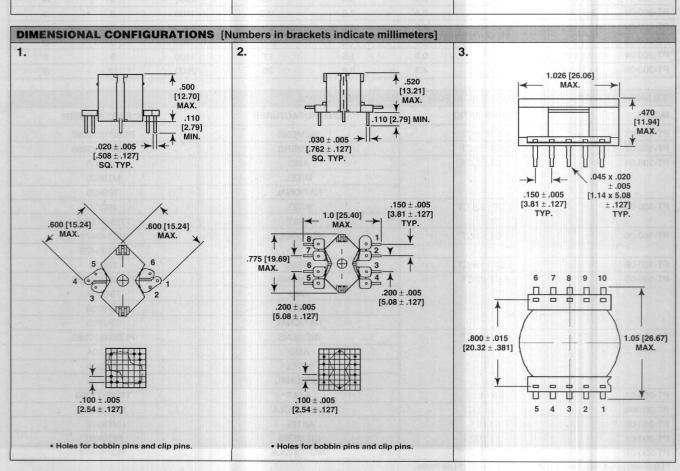
STANDA	RD ELECTRIC	AL SPECIFICA	TIONS	是不知识的	TENER DEP	经产业 的基础		
MODEL	TURNS RATIO	PRIMARY INDUCTANCE MIN. (mH)	PRIMARY DCR MAX. (Ohms)	SECONDARY DCR MAX. (Ohms)	LEAKAGE INDUCTANCE MAX. (μH)	PRIMARY/ SECONDARY HIPOT (V RMS)	STYLE NUMBER	SCHEMATIC NUMBER
PT-100-01	1 CT : 2 CT	20	1.2	11.0	30	1500	1	1
PT-100-02	1 CT : 2 CT	20	1.2	11.0	30	1500	2	2
PT-100-04	1 CT : 2 CT	20	3.0	4.5	15	1500	4	4
PT-100-05	1 CT : 2.5 CT	22	2.8	6.5	20	1500	1	1
PT-100-06	1 CT : 1 CT	22	2.8	2.8	10	1500	5	6
PT-100-08	1 CT : 1.8 CT	22	2.8	5.5	20	1500	1	1
PT-100-09	1 CT : 2 CT	22	8.0	15.0	30	1500	7	5
PT-100-11	1 CT : 2 CT	22	2.8	5.5	10	2000	9	4
PT-200-01	2.5:1:1	72	8.5	1.0	160	1100	3	3
PT-200-02	1:1:1 CT	25	5.5	3.5	20	1100	6	7
PT-200-03	4:1:1	30	2.3	1.0	200	1100	8	8
PT-200-04	1:1.32	7	0.9	1.5	17	1100	3	5
PT-200-05	1:1:1 CT	25	4.3	3.8	20	2000	10	9

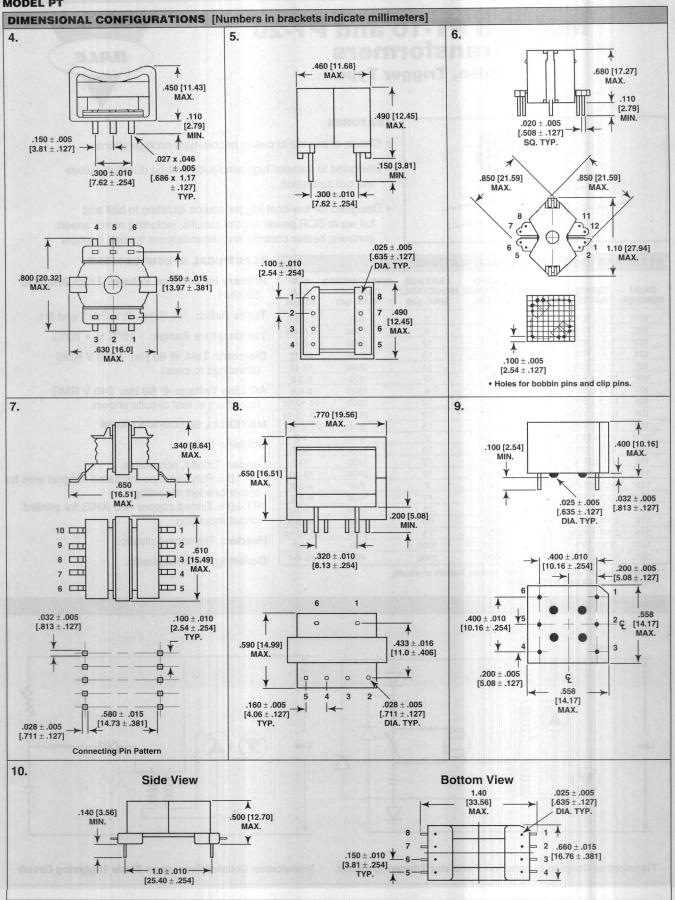
MODEL	TURNS RATIO	IC MANUFACTURER	IC PART NUMBER
PT-100-01	1 CT : 2 CT	SIEMENS	PEB2080/2085
PT-100-02	1 CT : 2 CT	SIEMENS	PEB2080/2085
PT-100-04	1 CT : 2 CT	AMD	79C30A
950. x.880. y		MITEL	MT8930
63.83.82.83		NATIONAL	TP3420
PT-100-05	1 CT : 2.5 CT	INTEL	29C53
		AT&T	T7250/T7252
PT-100-06	1 CT : 1 CT	MOTOROLA	MC145474
			MC145475
PT-100-08	1 CT : 1.8 CT	INTEL	29C53
PT-100-09	1 CT : 2 CT	SIEMENS	PEB2080/2085
		AMD	79C30A
		MITEL	MT8930
		NATIONAL	TP3420
PT-100-11*	1 CT : 2 CT	SIEMENS	PEB2080/2085
		AMD	79C30A
		MITEL	MT8930
		NATIONAL	TP3420
PT-200-01	2.5:1:1	AT&T	T7262/T7263
PT-200-02	1:1:1 CT	MOTOROLA	MC145472
PT-200-03	4:1:1	MITEL	MT8972
PT-200-04	1:1.32	SIEMENS	PEB2091
PT-200-05*	1:1:1 CT**	MOTOROLA	MC145472

^{*} Hipot voltage will meet International Safety Standards. ** Low Profile.

MODEL PT



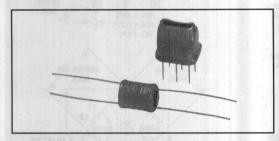




MODELS PT-10 and PT-20 Transformers

Pulse, Trigger Type





FEATURES

- · Choice of printed circuit or bobbin-type configurations
- Designed to transfer high amplitude or long duration pulses without saturation
- Designed for low-cost trigger source isolation in half and full wave SCR power control circuits, including motor speed controls, heater controls and incandescent lighting controls

DASH NUMBER	TURNS RATIO	FIGURE	PRIMARY INDUCTANCE MIN. (µH)	LEAKAGE INDUCTANCE MAX. (μH)	INTERWINDING CAPACITY MAX. (pF)	DCR MAX. (Ohms)
101*	1:1 ± 10%	1/3	200	3	800	1.5-1.5
102*	1:1 ± 10%	1/3	500	6	1500	4.5-4.5
103*	1:1 ± 10%	1/3	1000	12	2000	8-8
104	1:1 ± 10%	1/3	2000	13	2800	12-12
105	1:1 ± 10%	1/3	5000	15	3500	18-18
106*	1:1:1 ± 10%	2/4	200	3	800	2-2-2
107	1:1:1 ± 10%	2/4	500	6	1500	6-6-6
108	1:1:1 ± 10%	2/4	1000	12	2000	10-10-10
109	1:1:1 ± 10%	2/4	2000*	13	2800	15-15-15
110	1:1:1 ± 10%	2/4	5000	15	3500	27-27-27
111*	2:1 ± 10%	1/3	500	6	1000	4-2
112*	2:1 ± 10%	1/3	1000	10	1300	10-2
113	2:1 ± 10%	1/3	2000	12	1800	10-5
114	2:1 ± 10%	1/3	5000	15	2400	18-10
115*	2:1:1 ± 10%	2/4	200	8	700	4-2-2
116*	2:1:1 ± 10%	2/4	500	11	1000	6-2-2
117*	2:1:1 ± 10%	2/4	1000	15	1300	10-2-2
118	2:1:1 ± 10%	2/4	2000	60	2000	10-5-5
119	2:1:1 ± 10%	2/4	5000	75	2100	20-10-10
120*	5:1 ± 10%	1/3	5000	1500	400	19-3
121	5:1:1 ± 10%	2/4	5000	1500	400	20-4-4

^{*} Standard items in PT-10 Model. Other dash numbers available on request. All dash numbers standard in PT-20 Model.

ELECTRICAL SPECIFICATIONS

Primary Inductance Values: From 200μH to

5000μΗ.

Turns Ratio: 1:1, 1:1:1, 2:1, 2:1:1 and 5:1.

Temperature Range: - 10°C to + 70°C.

Dielectric Test @ 60 Hz: 1600 V RMS

(Windings to case).

AC Line Voltage @ 60 Hz: 240 V RMS maximum in test circuits shown.

MATERIAL SPECIFICATIONS

Bobbin: Nylon.

Leads: Tinned, solderable.

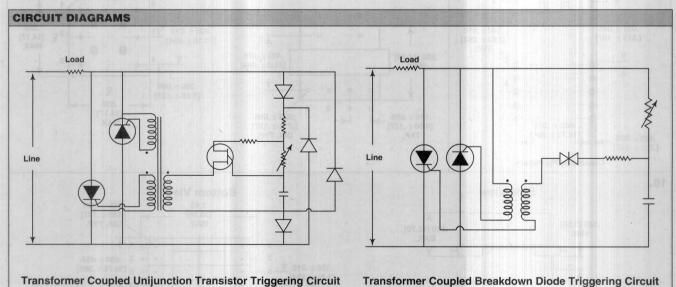
PT-10 = Polyurethane insulated magnet wire for

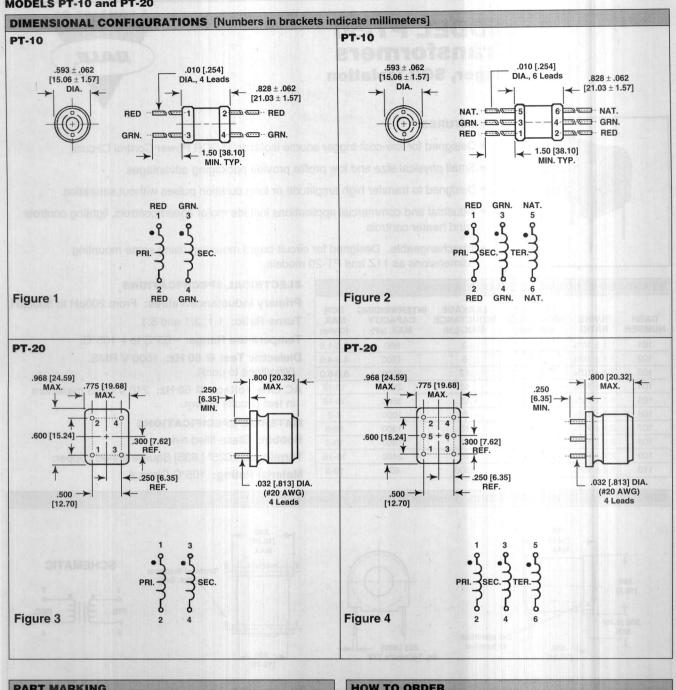
clip or bracket mounting.

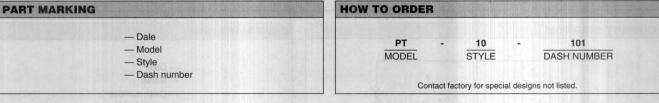
PT-20 = Tinned copper #20 AWG for printed

circuit mounting.

Header: Thermoset plastic. **Covering:** Thermoplastic.



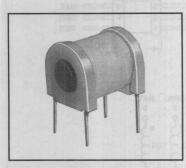




MODEL PT-50 Transformers

Trigger, SCR Isolation





FEATURES

- Designed for low-cost trigger source isolation in SCR Power Control Circuits
- Small physical size and low profile provide packaging advantages
- Designed to transfer high amplitude or long duration pulses without saturation
- Industrial and commercial applications include motor speed controls, lighting controls and heater controls
- Interchangeable. Designed for circuit board mounting using same mounting dimensions as 11Z and PT-20 models.

STANDA	ARD ELEC	CTRICAL SP	ECIFICATIO	NS	
DASH NUMBER	TURNS RATIO	PRIMARY INDUCTANCE MIN. (μH)	LEAKAGE INDUCTANCE MAX. (μH)	INTERWINDING CAPACITY MAX. (pF)	DCR MAX. (Ohms)
101	1:1 ± 10%	200	3	800	1.5-1.5
102	1:1 ± 10%	500	6	1500	4.5-4.5
103	1:1 ± 10%	1000	12	2000	8.0-8.0
104	1:1 ± 10%	2000	13	2800	12-12
105	1:1 ± 10%	5000	15	3500	18-18
106	2:1 ± 10%	500	6	1000	4-2
107	2:1 ± 10%	1000	10	1300	10-2
108	2:1 ± 10%	2000	12	1800	10-5
109	2:1 ± 10%	5000	15	2400	18-10
110	5:1 ± 10%	5000	1500	400	19-3

ELECTRICAL SPECIFICATIONS

Primary Inductance Values: From 200μH to 5000μH.

Turns Ratio: 1:1, 2:1 and 5:1.

Temperature Range: - 55°C to + 105°C. Dielectric Test @ 60 Hz: 1600 V RMS.

(Windings to core).

AC Line Voltage @ 60 Hz: 240 V RMS maximum

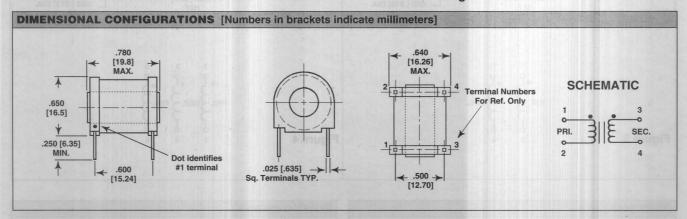
in test circuits shown.

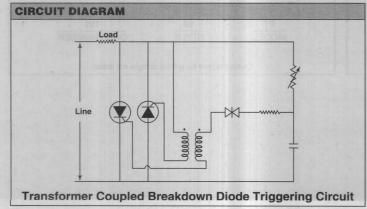
MATERIAL SPECIFICATIONS

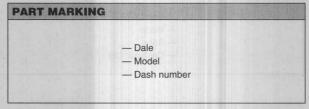
Bobbin: Glass-filled nylon.

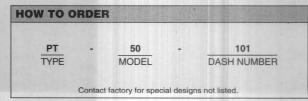
Terminals: .025" [.635] Square tinned copper.

Material Rating: 105°C Class A.









STAND	ARD EL	ECTRICAL SPECIFICA	ALIONS		
MODEL	INPUT	OUTPUT	FREQ. REF. (kHz)	CIRCUIT EFF.	SCHEMATIC NUMBER
TC 10-01	3.6 VDC	+7.2 ± .2 VDC at 150 MW -7.2 ± .2 VDC at 150 MW	7.5	50%	ariolisoilg
TC 10-02	5 VDC	200 ± 10 VDC at 250 MW	11	64%	4
TC 10-03	5 VDC	200 ± 10 VDC at 250 MW + 15 ± .4 VDC at 125 MW - 15 ± .4 VDC at 125 MW	11	60%	2
TC 10-04	5 VDC	+ 15 ± .4 VDC at 500 MW - 15 ± .4 VDC at 500 MW	8	75%	1
TC 10-05	5 VDC	+ 170 \pm 5.1 VDC at 850 MW + 32 \pm 1.0 VDC at 510 MW	11	75%	5
TC 10-06	5 VDC	+ 35 ± 1.0 VDC at 610 MW	11	70%	5*
TC 10-07	7.5 VDC	+ 16.3 \pm .4 VDC at 330 MW - 16.3 \pm .4 VDC at 330 MW	7	65%	1 _{sk} one
TC 10-08	12 VDC	+ 15 ± .4 VDC at 1 W - 15 ± .4 VDC at 1 W	7.5	72%	1
TC 10-09	12 VDC	160 ± 5 VDC at 1.5 W	10	75%	3
TC 10-10	12 VDC	14.2 ± .7 VDC at 3 W	10	70%	1
TC 10-11	12 VDC	+ 24 ± .5 VDC at 2 W	10	80%	1
TC 10-12	24 VDC	170 ± 5.1 VDC at 850 MW 32 ± 1.0 VDC at 510 MW	11	70%	5

^{*} Specifications relate to transformer when operated in applicable test circuit and at specified load power.

APPLICATIONS

Power supply for gas discharge display, batteryoperated portable instruments, operational amplifier power supplies.

ELECTRICAL SPECIFICATIONS

Transformer Power Rating: 3 watt.

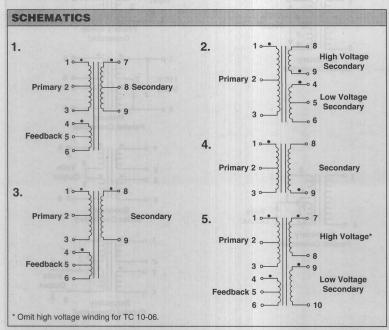
Isolation, Primary-Secondary: 500 V 60 Hz. Operating characteristics may be varied to suit specific applications by appropriate selection of circuit components.

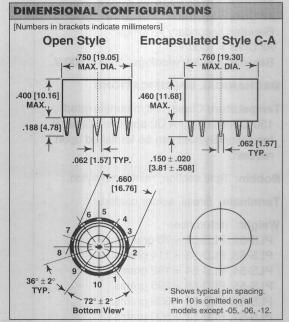
Operating Temperature Range: - 20°C to + 80°C. Intended for use in enclosed commercial and industrial applications.

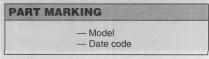
MECHANICAL SPECIFICATIONS

Coating: Varnish dip coat or epoxy encapsulated.

Terminals: .015" [.381] thick, solder plated, varnish-free. Intended for PC board mounting.





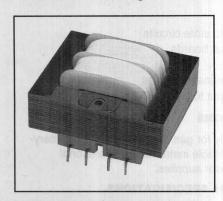


TC-10	- 01	A
MODEL	DASH NUMBER	ENCAPSULATED STYLE Leave blank for open style.

MODELS PLS and PLD Power Transformers

Single Primary - Dual Secondary, 6 Pin, 115 Volts Dual Primary - Dual Secondary, 8 Pin 115/230 Volts





FEATURES

- PC pin mounting
- · Provides isolation from power line
- PLD: Dual Primary for operational 115 V or 230 V, 50/60 Hz
- Modification to these standard items are available as specialty products
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- Designed to meet UL and CSA requirements
- Dual Secondary for series
 connection obtains twice winding
 voltage with center tap or for
 parallel connection obtains twice
 winding current rating
- Split-section winding for increased dielectric strength between primary and secondary windings, plus reduced interwinding capacitance

Secondary Parallel Connected

ELECTRICAL SPECIFICATIONS

Input Voltage:

PLS = 115 V 50-60 Hz. PLD = 115 V 60 Hz or 230 V 50-60 Hz.

Output Power Rating:

PLS-52, PLD-52 = 1.1 VA. PLS-53, PLD-53 = 2.4 VA. PLS-54, PLD-54 = 6.0 VA. PLS-55, PLD-55 = 12.0 VA.

PLS-56, PLD-56 = 20.0 VA.

PLS-57, PLD-57 = 36.0 VA.

Dielectric Strength: Primary to secondary windings and all windings to core:

All Units = 2500 V.

Between secondary windings:

All Units = 1000 V.

Between primary windings: PLD = 500 V.

MECHANICAL SPECIFICATIONS

Temperature Class: All materials rated 130°C minimum. A UL approved Class B Insulation System can be furnished upon request.

Bobbin: Split section, reinforced nylon.

Terminals: Brass, solder coated.

Weight: (reference)

PLS-52, PLD-52 = 73 grams.

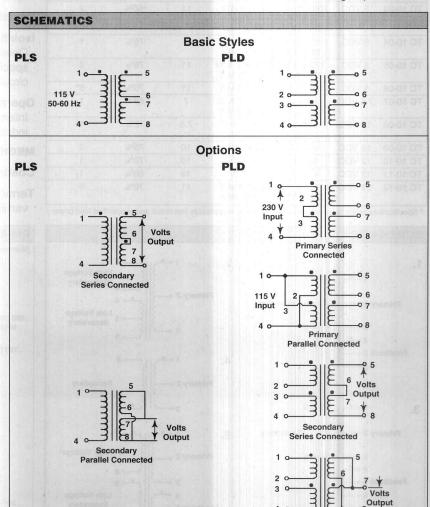
PLS-53, PLD-53 = 114 grams.

PLS-54, PLD-54 = 182 grams.

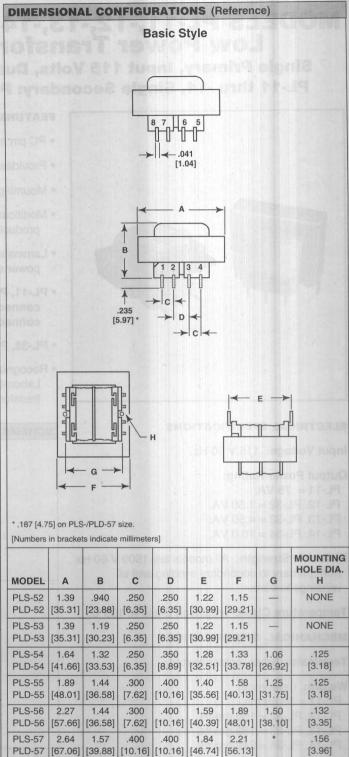
PLS-55, PLD-55 = 295 grams.

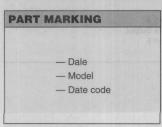
PLS-56, PLD-56 = 386 grams.

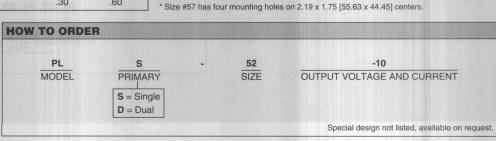
PLS-57, PLD-57 = 500 grams.



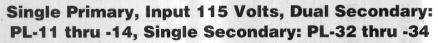
OUTPUT	VOLTAGE	TABL	EF AVE.			
		OUTPUT	VOLTAGE	OUTPUT CURRENT (A)		
MODEL	MODEL	SERIES	PARALLEL	SERIES	PARALLEL	
PLS-52-10	PLD-52-10	10 VCT	5 V	.11	.22	
PLS-53-10	PLD-53-10			.25	.50	
PLS-54-10	PLD-54-10			.60	1.2	
PLS-55-10	PLD-55-10			1.2	2.4	
PLS-56-10	PLD-56-10			2.0	4.0	
PLS-57-10	PLD-57-10			3.6	7.2	
PLS-52-12	PLD-52-12	12.6 VCT	6.3 V	.09	.18	
PLS-53-12	PLD-53-12			.20	.40	
PLS-54-12	PLD-54-12			.50	1.0	
PLS-55-12	PLD-55-12			1.0	2.0	
PLS-56-12	PLD-56-12			1.6	3.2	
PLS-57-12	PLD-57-12			2.85	5.7	
PLS-52-16	PLD-52-16	16 VCT	8 V	.07	.14	
PLS-53-16	PLD-53-16	JISTISVIG	ON STREET	.15	.30	
PLS-54-16	PLD-54-16			.40	.80	
PLS-55-16	PLD-55-16			.80	1.6	
PLS-56-16	PLD-56-16			1.25	2.5	
PLS-57-16	PLD-57-16			2.25	4.5	
PLS-52-20	PLD-52-20	20 VCT	10 V	.055	.11	
	PLD-53-20	20 101	She laud	:12	.24	
PLS-54-20	PLD-54-20			.30	.60	
PLS-55-20	PLD-55-20			.60	1.2	
PLS-56-20	PLD-56-20			1.0	2.0	
PLS-57-20	PLD-57-20			1.8	3.6	
PLS-52-24	PLD-52-24	24 VCT	12 V	.045	.09	
PLS-52-24 PLS-53-24	PLD-52-24 PLD-53-24	24 VC1	12 V	.10	.20	
PLS-53-24	PLD-53-24 PLD-54-24			.25	.50	
PLS-55-24				.50	1.0	
PLS-56-24	PLD-55-24 PLD-56-24			.80	1.6	
PLS-57-24	PLD-50-24			1.5	3.0	
PLS-52-28	PLD-52-28	28 VCT	14 V	.04	.08	
PLS-53-28	PLD-53-28	20 101		.085	.17	
PLS-54-28	PLD-54-28			.20	.40	
PLS-55-28	PLD-55-28			.42	.84	
PLS-56-28	PLD-56-28			.70	1.4	
PLS-57-28	PLD-57-28			1.3	2.6	
PLS-52-36	PLD-52-36	36 VCT	18 V	.03	.06	
PLS-53-36	PLD-53-36	00 101	10 1	.065	.13	
PLS-54-36	PLD-54-36			.17	.34	
PLS-55-36	PLD-55-36			.35	.70	
PLS-56-36	PLD-56-36			.55	1.1	
PLS-57-36	PLD-57-36			1.0	2.0	
PLS-52-48	PLD-52-48	48 VCT	24 V	.023	.046	
PLS-53-48	PLD-53-48			.05	.10	
PLS-54-48	PLD-54-48			.125	.25	
PLS-55-48	PLD-55-48			25	.50	
PLS-56-48	PLD-56-48			.40	.80	
PLS-57-48	PLD-57-48	and her	W. S. S. C.	.75	1.5	
PLS-52-56	PLD-52-56	56 VCT	28 V	.02	.04	
PLS-53-56	PLD-53-56			.045	.09	
PLS-54-56	PLD-54-56			.11	.22	
PLS-55-56	PLD-55-56			.22	.44	
PLS-56-56	PLD-56-56			.35	.70	
PLS-57-56	PLD-57-56	HE I		.65	1.3	
PLS-52-120	PLD-52-120	120 VCT	60 V	.01	.02	
PLS-53-120	PLD-53-120	100		.02	.04	
PLS-54-120	PLD-54-120	1000		.05	.10	
PLS-55-120	PLD-55-120)		.10	.20	
PLS-56-120	PLD-56-120)		.16	.32	
PLS-57-120	PLD-57-120)		.30	.60	



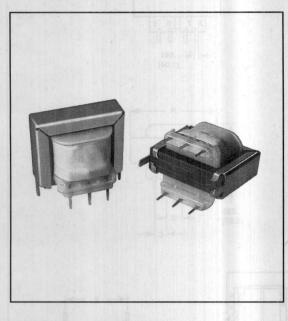




MODELS PL-11,-12,-13,-14,-32,-33,-34 Low Power Transformers







ELECTRICAL SPECIFICATIONS

Input Voltage: 115 V 60 Hz.

Output Power Rating:

PL-11 = .75 VA.

PL-12, PL-32 = 1.50 VA.

PL-13, PL-33 = 4.50 VA.

PL-14, PL-34 = 10.0 VA.

Dielectric Strength: All models are 1500 V 60 Hz from primary to secondary winding and all windings to core.

Temperature Class: Insulation Class A, 105°C.

MECHANICAL SPECIFICATIONS

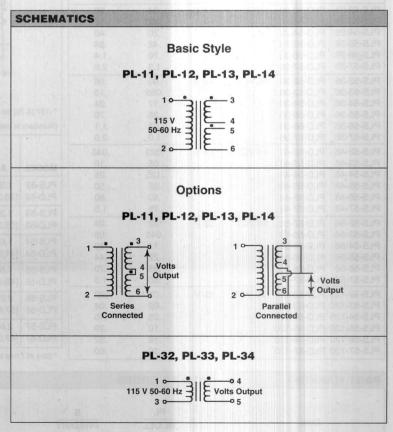
Terminals: Brass, solder coated.

Weight: (reference) PL-11 = 35 grams.

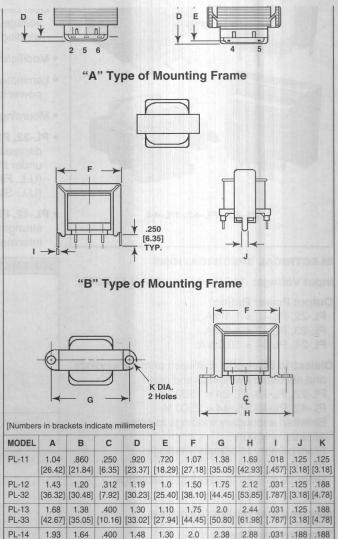
PL-12, PL-32 = 100 grams. PL-13, PL-33 = 160 grams. PL-14, PL-34 = 240 grams.

FEATURES

- · PC pin mounting
- Provides isolation from power line
- · Mounting frames and bobbin standoff are available
- Modification to these standard items are available as specialty products
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- PL-11, PL-12, PL-13, PL-14: Dual secondaries for series connection to obtain twice voltage with center tap or parallel connection for twice current rating
- PL-32, PL-33, PL-34: Single secondary and lower cost construction
- Recognized under the Component Program of Underwriters Laboratories, Inc., U.L. File E71961. For general purpose transformers (U.L. Standard 506).



		14					
PL-11-04 PL-12-04 PL-13-04 PL-14-04	15 VCT	7.5 V	50 100 300 500	100 200 600 1000	PL-32-04 PL-33-04 PL-34-04	15 V	80 300 550
PL-11-05 PL-12-05 PL-13-05 PL-14-05	16 VCT	8 V	47 75 260 640	94 150 520 1280			
PL-11-06 PL-12-06 PL-13-06 PL-14-06	20 VCT	10 V	38 60 220 500	76 120 440 1000	PL-32-05 PL-33-05 PL-34-05	20 V	60 225 400
PL-11-07 PL-12-07 PL-13-07 PL-14-07	24 VCT	12 V	31 50 180 450	62 100 360 900	PL-32-06 PL-33-06 PL-34-06	24 V	50 185 330
PL-11-08 PL-12-08 PL-13-08 PL-14-08	30 VCT	15 V	25 50 150 250	50 100 300 500	PL-32-07 PL-33-07 PL-34-07	30 V	40 150 270
PL-11-09 PL-12-09 PL-13-09 PL-14-09	34 VCT	17 V	22 35 125 300	44 70 250 600	eebne v	enging e De peso e	balween ing cap
PL-11-10 PL-12-10 PL-13-10 PL-14-10	40 VCT	20 V	19 30 110 250	38 60 220 500			
PL-12-11 PL-13-11 PL-14-11	54 VCT	27 V	28 84 140	56 168 280	PL-32-08 PL-33-08 PL-34-08	54 V	22 80 150
PL-12-12 PL-13-12 PL-14-12	56 VCT	28 V	20 80 180	40 160 360			
PL-12-13 PL-13-13 PL-14-13	76 VCT	38 V	20 60 100	40 120 200	PL-32-09 PL-33-09 PL-34-09	76 V	16 60 110
PL-12-14 PL-13-14 PL-14-14	88 VCT	44 V	15 50 120	30 100 240	PL-32-10 PL-33-10 PL-34-10	88 V	14 50 90
				Tano	PL-32-11 PL-33-11 PL-34-11	115 V	10 40 70
PL-12-15 PL-13-15 PL-14-15	120 VCT	60 V	10 35 85	20 70 170			
PL-12-16 PL-13-16 PL-14-16	180 VCT	90 V	6 24 55	12 48 110	PL-32-12 PL-33-12 PL-34-12	180 V	7 25 45
PL-12-17 PL-13-17 PL-14-17	230 VCT	115 V	5 20 40	10 40 80	PL-32-13 PL-33-13 PL-34-13	230 V	5 20 35



[49.02] [41.66] [10.16] [37.59] [33.02] [50.80] [60.45] [73.15] [.787] [4.78]

PART MARKING - Dale - Model - Date code

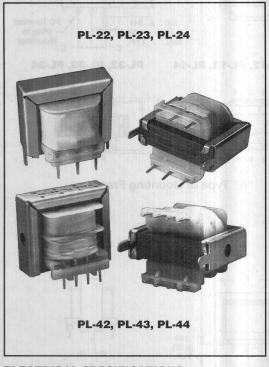
HOW TO ORE	ER		
PL-11 MODEL	-01 OUTPUT VOLTAGE AND CURRENT	A MOUNTING FRAME (If not required, leave blank.)	S * FOR BOBBIN STANDOFF (If not required, leave blank.)
			.063 [1.60] Bobbin Standoff
Special design not lis	sted, available on request.		Standoff option not available on PL-11 siz

PL-34

MODELS PL-22, -23, -24, -42, -43, -44 Low Power Transformers

Dual Primary - Dual Secondary 115/230 Volts





ELECTRICAL SPECIFICATIONS

Input Voltage: 115 V 60 Hz or 230 V 50-60 Hz.

Output Power Rating:

PL-22, PL-42 = 1.5 VA. PL-23, PL-43 = 4.5 VA.

PL-24, PL-44 = 10.0 VA.

Dielectric Strength: Between primary windings and secondary windings and core:

PL-22, PL-23, PL-24 = 1500 V.

PL-42, PL-43, PL-44 = 2500 V.

Between secondary windings to core:

All units = 1000 V.

From primary to primary windings:

All units = 500 V.

From secondary to secondary windings:

All Units = 500 V.

MECHANICAL SPECIFICATIONS

Temperature Class:

PL-22, PL-23, PL-24: Insulation Class A, 105°C. PL-42, PL-43, PL-44: Insulation Class B, 130°C; A UL approved Class B Insulation System can be furnished on request.

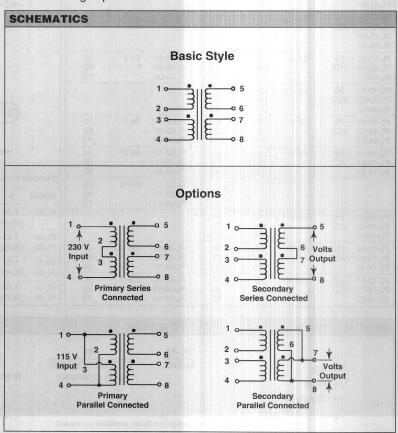
Terminals: Brass, solder coated.

Weight: (reference)

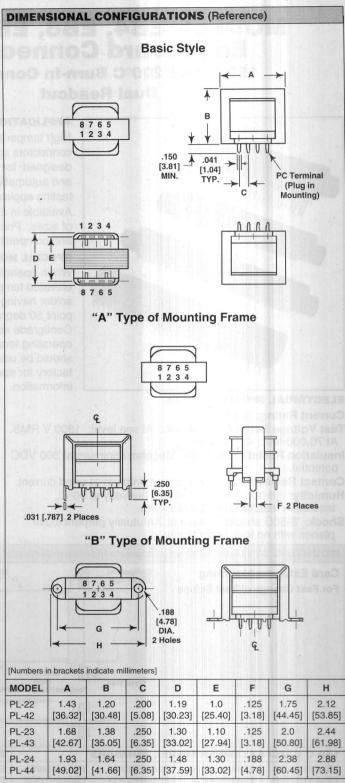
PL-22, PL-42 = 100 grams. PL-23, PL-43 = 160 grams. PL-24, PL-44 = 240 grams.

FEATURES

- · PC pin mounting
- · Provides isolation from power line
- Dual Primary for operation at 115 V or 230 V, 50/60 Hz
- · Designed to meet UL requirements
- Dual Secondary for series connection obtains twice winding voltage with center tap or for parallel connection obtains twice winding current rating
- Modification to these standard items are available as specialty products
- Laminated construction for low-cost industrial applications, including power supplies, controls and instrumentation
- · Mounting brackets and bobbin standoff are available
- PL-22, PL-23, PL-24: Concentric windings for increased coupling, decreased leakage reactance and improved regulation. Recognized under the Component Program of Underwriters Laboratories, Inc. (U.L. File E71961). For General Purpose Transformers (U.L. Standard 506).
- PL-42, PL-43, PL-44: Split-section winding for increased dielectric strength between primary and secondary windings plus reduced interwinding capacitance



OUTPUT V	OLTAGE	ABLE			
MODEL	SPLIT-	OUTPUT	VOLTAGE		CURRENT
CONCENTRIC WINDINGS	WINDINGS	SERIES P	ARALLEL	SERIES	PARALLEL
PL-22-01	PL-42-01	8 VCT	4 V	188	376
PL-23-01	PL-43-01			562	1124
PL-24-01	PL-44-01			940	1880
PL-22-02	PL-42-02	10 VCT	5 V	120	240
PL-23-02	PL-43-02			440	880
PL-24-02	PL-44-02	01, 000	PIP S	1000	2000
PL-22-03	PL-42-03	12.6 VCT	6.3 V	100	200
PL-23-03	PL-43-03			350	700
PL-24-03	PL-44-03	connector	o okonec	800	1600
PL-22-04	PL-42-04	15 VCT	7.5 V	100	200
PL-23-04	PL-43-04			300	600
PL-24-04	PL-44-04	egges vill	idalist or	500	1000
PL-22-05	PL-42-05	16 VCT	8 V	75	150
PL-23-05	PL-43-05 PL-44-05			260	520 1280
PL-24-05	PL-44-05	Z10.1.801	STATE OF	640	1280
PL-22-06	PL-42-06	20 VCT	10 V	60	120
PL-23-06 PL-24-06	PL-43-06 PL-44-06			220 500	440 1000
SCHOOL STATE	BIRTH I THE	- ET 10 TO 1	Herita III	ELL TETR	· alte
PL-22-07	PL-42-07	24 VCT	12 V	50	100
PL-23-07 PL-24-07	PL-43-07 PL-44-07			180 450	360 900
		SECTION AND AND AND AND AND AND AND AND AND AN			1012102 30
PL-22-08	PL-42-08	30 VCT	15 V	50	100
PL-23-08 PL-24-08	PL-43-08 PL-44-08			150 250	300 500
		OAMOT	17 V	U. Alle	
PL-22-09 PL-23-09	PL-42-09 PL-43-09	34 VCT	17 V	35 125	70 250
PL-24-09	PL-44-09			300	600
PL-22-10	PL-42-10	40 VCT	20 V	30	60
PL-23-10	PL-43-10	40 001	20 V	110	220
PL-24-10	PL-44-10			250	500
PL-22-11	PL-42-11	54 VCT	27 V	28	56
PL-23-11	PL-43-11		10497016	84	168
PL-24-11	PL-44-11			140	280
PL-22-12	PL-42-12	56 VCT	28 V	20	40
PL-23-12	PL-43-12			80	160
PL-24-12	PL-44-12			180	360
PL-22-13	PL-42-13	76 VCT	38 V	20	40
PL-23-13	PL-43-13			60	120
PL-24-13	PL-44-13			100	200
PL-22-14	PL-42-14	88 VCT	44 V	15	30
PL-23-14	PL-43-14			50	100
PL-24-14	PL-44-14			120	240
PL-22-15	PL-42-15	120 VCT	60 V	10	20
PL-23-15	PL-43-15			35	70
PL-24-15	PL-44-15		100-3	85	170
PL-22-16	PL-42-16	180 VCT	90 V	6	12
PL-23-16	PL-43-16			24	48
PL-24-16	PL-44-16			55	110
PL-22-17	PL-42-17	230 VCT	115 V	5	10
PL-23-17	PL-43-17			20	40
PL-24-17	PL-44-17			40	80



PART MARKING - Dale - Model - Date code

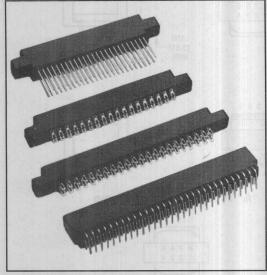
PL-22	-01	A	В		
MODEL	OUTPUT VOLTAGE AND CURRENT	MOUNTING FRAME (If not required, leave blank.)	FOR BOBBIN STANDOFF (If not required, leave blank.)		
			.063 [1.60] Bobbin Standoff		

MODELS EB4, EB6, EB7, EB8 Edgeboard Connectors

150°C and 200°C Burn-In Connectors

Dual Readout





ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Test Voltage Between Contacts: At sea level: 1800 V RMS.

At 70,000 feet: 450 V RMS.

Insulation Resistance: 5,000 Megohm minimum at 500 VDC potential.

Contact Resistance: 30 millivolts maximum at rated current. Humidity: 48 hours at 95% relative humidity at 90°C,

insulation resistance 5,000 Megohm.

Shock: 3-50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

APPLICATIONS

High temperature, long life connectors specifically designed for burn-in oven and automatic temperature testing applications.

Available in a wide range of sizes. Priced affordably and competitively.

SPECIAL NOTE:

When operating units at elevated temperatures, solder having a melting point 50 degrees
Centigrade above the operating temperature should be used. Contact factory for specific solder information.

FEATURES

- EB4, .100" [2.54] C-C. EB6, .125" [3.17]. EB7 and EB8, .156" [3.96] C-C.
- Right angle styles included for all models
- High temperature, glass reinforced phenolic connector bodies - 150°C
- High temperature, glass reinforced PPS connector bodies - 200°C
- High reliability copper-nickel-tin alloy contacts
- Accepts P.C. board thickness of .054" to .071" [1.37 to 1.80]
- High reliability bifurcated bellows contacts
- · Gold-plated contacts
- · Card extender style terminals standard
- · Variety of mounting styles available
- Recognized under the Component Program of Underwriters Laboratories, Inc. Listed under File E65524.

MATERIAL SPECIFICATIONS

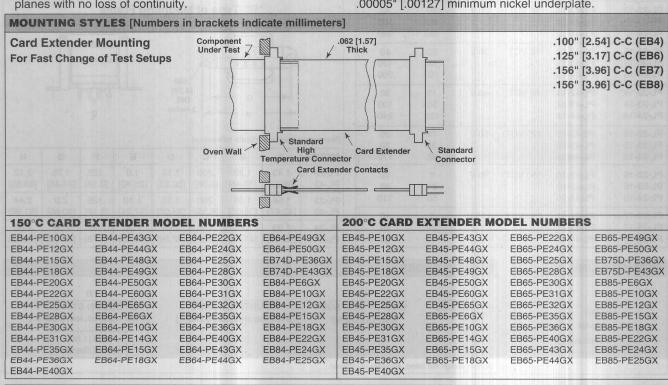
Body Material:

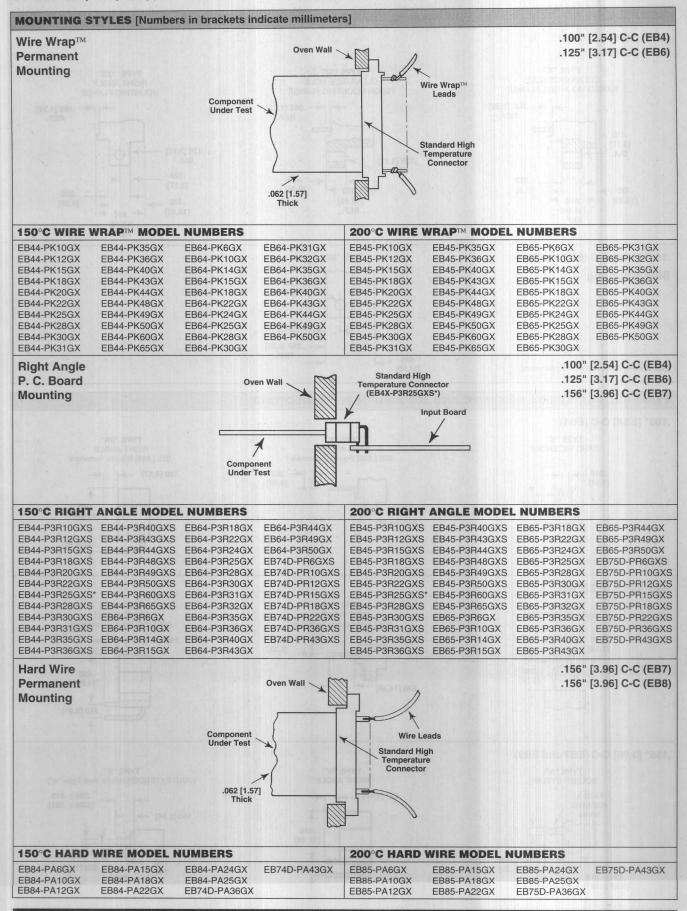
150°C Connectors: Fiberglass reinforced phenolic, 150°C operating temperature, flame-retardant (UL94V-O).

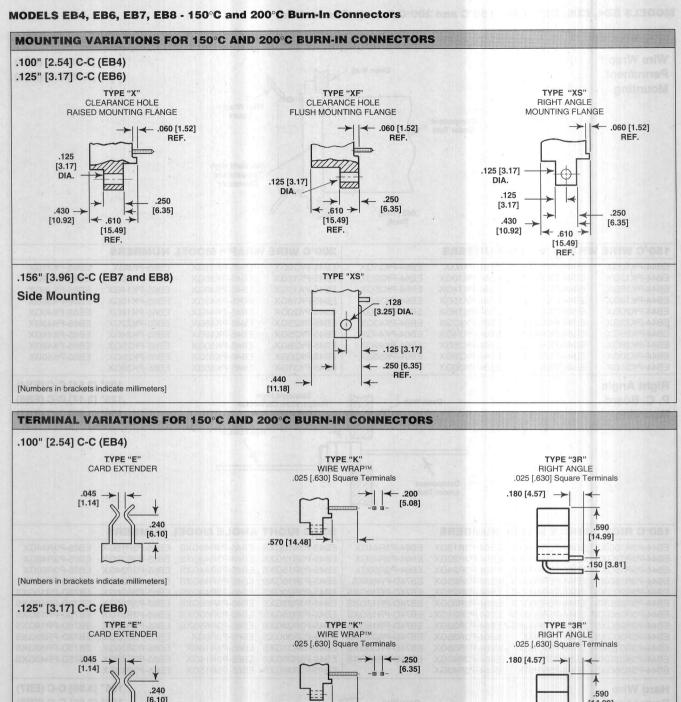
200°C Connectors: Fiberglass reinforced polyphenylene sulfide, 200°C operating temperature, flame-retardant (UL94V-O).

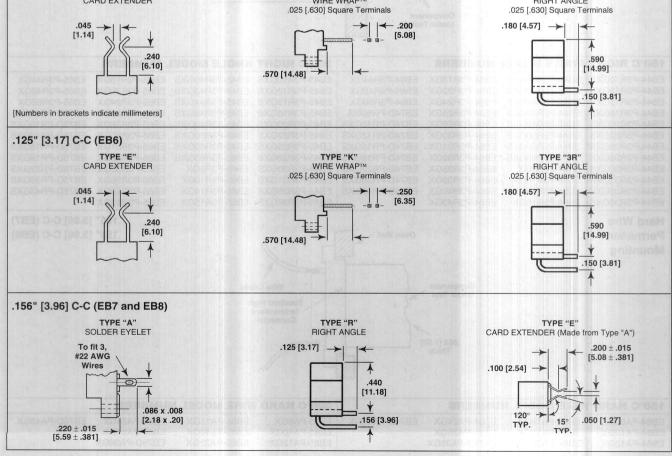
Contacts: Copper-nickel-tin alloy per ASTM B 740.

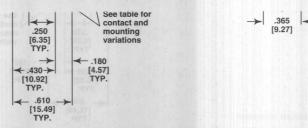
Plating: Gold plating (.00003" [.000762] thick), over .00005" [.00127] minimum nickel underplate.











[Numbers in brackets indicate millimeters]

MODEL - PART NUMBER	# OF CONTACT POSITIONS PER SIDE	A	В	C	D	TRATACO POS CONTRACTOR DE LA CONTRACTOR	CARD SLOT DEPTH
EB4 ≭ -P□10G∆	10	1.835 [46.61]	1.575 [40.00]	1.100 [27.94]	1.260 [32.00]	1.150 [29.21]	.300 [7.62]
EB4 ≭ -P□12GΔ	12	2.035 [51.69]	1.775 [45.08]	1.300 [33.02]	1.460 [37.08]	1.350 [34.29]	.300 [7.62]
EB4 ≭ -P□15G∆	15	2.335 [59.31]	2.075 [52.70]	1.600 [40.64]	1.760 [44.70]	1.650 [41.91]	.300 [7.62]
EB4 ≭ -P□18G∆	18	2.635 [66.93]	2.375 [60.32]	1.900 [48.26]	2.060 [52.32]	1.950 [49.53]	.300 [7.62]
EB4 ≭ -P□20GΔ	20	2.835 [72.01]	2.575 [65.40]	2.100 [53.34]	2.260 [57.40]	2.150 [54.61]	.300 [7.62]
EB4 ≭ -P□22GΔ	22	3.035 [77.09]	2.775 [70.48]	2.300 [58.42]	2.460 [62.48]	2.350 [59.69]	.300 [7.62]
EB4 ≭ -P□25G∆	25	3.335 [84.71]	3.075 [78.10]	2.600 [66.04]	2.760 [70.10]	2.650 [67.31]	.300 [7.62]
EB4 ≭ -P□28G∆	28	3.635 [92.33]	3.375 [85.72]	2.900 [73.66]	3.060 [77.72]	2.950 [74.93]	.300 [7.62]
EB4 ≭ -P□30G∆	30	3.835 [97.41]	3.575 [90.80]	3.100 [78.74]	3.260 [82.80]	3.150 [80.01]	.300 [7.62]
EB4 ≭ -P□31G∆	31	3.935 [99.95]	3.675 [93.34]	3.200 [81.28]	3.360 [85.34]	3.250 [82.55]	.300 [7.62]
EB4 ≭ -P□35G∆	35	4.335 [110.11]	4.075 [103.50]	3.600 [91.44]	3.760 [95.50]	3.650 [92.71]	.300 [7.62]
EB4 ≭ -P□36G∆	36	4.435 [112.65]	4.175 [106.04]	3.700 [93.98]	3.860 [98.04]	3.750 [95.25]	.300 [7.62]
EB4 ≭ -P□40G∆	40	4.835 [122.81]	4.575 [116.20]	4.100 [104.14]	4.260 [108.20]	4.150 [105.41]	.300 [7.62]
EB4 ≭ -P□43G∆	43	5.135 [130.43]	4.875 [123.82]	4.400 [111.76]	4.560 [115.82]	4.450 [113.03]	.300 [7.62]
EB4 ≭ -P□44G∆	44	5.235 [132.97]	4.975 [126.36]	4.500 [114.30]	4.660 [118.36]	4.550 [115.57]	.300 [7.62]
EB4 ≭ -P□48G∆	48	5.635 [143.13]	5.375 [136.52]	4.900 [124.46]	5.060 [128.52]	4.950 [125.73]	.300 [7.62]
EB4 ≭ -P□ 49G∆	49	5.735 [145.67]	5.475 [139.06]	5.000 [127.00]	5.160 [131.06]	5.050 [128.27]	.300 [7.62]
EB4 ≭ -P□50G∆	50	5.835 [148.21]	5.575 [141.60]	5.100 [129.54]	5.260 [133.60]	5.150 [130.81]	.300 [7.62]
EB4 ≭ -P□60G∆	60	6.835 [173.61]	6.575 [167.00]	6.100 [154.94]	6.260 [159.00]	6.150 [156.21]	.300 [7.62]
EB4 ≭ -P□65GΔ	65	7.335 [186.31]	7.075 [179.70]	6.600 [167.64]	6.760 [171.70]	6.650 [168.91]	.300 [7.62]

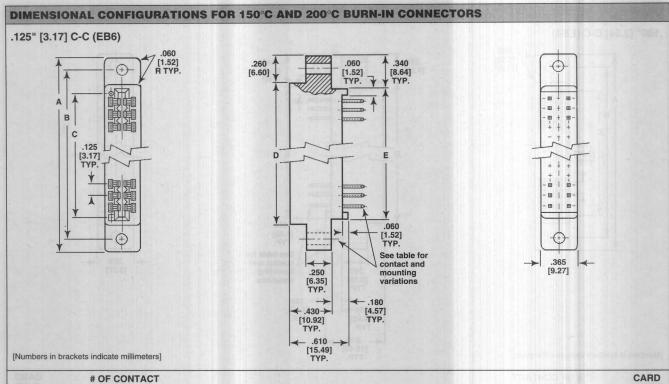
ORDERING INFORMATION

When ordering connectors using the above part numbers:

≭ = Indicate "4" for 150°C Burn-In Connectors, or "5" for 200°C Burn-In Connectors.

□ = Indicate "E" for Card Extender, "K" for Wire Wrap™, or "3R" for Right Angle Terminals.

 Δ = Indicate "X" for Standard Mounting, "XF" for Flush Mounting, or "XS" for Side Mounting.



MODEL - PART NUMBER	# OF CONTACT POSITIONS PER SIDE	A	В	c	D	E R	CARD SLOT DEPTH
EB6 ≭ -P□6G∆	6	1.555 [39.50]	1.295 [33.89]	.875 [22.22]	1.035 [26.29]	.875 [22.22]	.300 [7.62]
EB6 ≭ -P□10GΔ	10	2.055 [52.20]	1.795 [45.59]	1.375 [34.92]	1.535 [38.99]	1.375 [34.92]	.300 [7.62]
EB6 ≭ -P□14G∆	14	2.555 [64.90]	2.295 [58.29]	1.875 [47.62]	2.035 [51.69]	1.875 [47.62]	.300 [7.62]
EB6 ≭ -P□15GΔ	15	2.680 [68.07]	2.420 [61.47]	2.000 [50.80]	2.160 [54.86]	2.000 [50.80]	.300 [7.62]
EB6 ≭ -P□18G∆	18	3.055 [77.60]	2.795 [70.99]	2.375 [60.32]	2.535 [64.39]	2.375 [60.32]	.300 [7.62]
EB6 ≭ -P□22G∆	22	3.555 [90.30]	3.295 [83.69]	2.875 [73.02]	3.035 [77.09]	2.875 [73.02]	.300 [7.62]
EB6 ≭ -P□24G∆	24	3.805 [96.65]	3.545 [90.04]	3.125 [79.38]	3.285 [83.44]	3.125 [79.38]	.300 [7.62]
EB6 ≭ -P□25G∆	25	3.930 [99.82]	3.670 [93.22]	3.250 [82.55]	3.410 [86.61]	3.250 [82.55]	.300 [7.62]
EB6 ≭ -P□28G∆	28	4.305 [109.35]	4.045 [102.74]	3.625 [92.08]	3.785 [96.14]	3.625 [92.08]	.300 [7.62]
EB6 ≭ -P□30GΔ	30	4.555 [115.70]	4.295 [109.09]	3.875 [98.42]	4.035 [102.49]	3.875 [98.42]	.300 [7.62]
EB6 ≭ -P□31GΔ	31	4.680 [118.87]	4.420 [112.27]	4.000 [101.60]	4.160 [105.66]	4.000 [101.60]	.300 [7.62]
EB6 ≭ -P□32GΔ	32	4.805 [122.05]	4.545 [115.44]	4.125 [104.78]	4.285 [108.84]	4.125 [104.78]	.300 [7.62]
EB6 ≭ -P□35GΔ	35	5.180 [131.57]	4.920 [124.97]	4.500 [114.30]	4.660 [118.36]	4.500 [114.30]	.300 [7.62]
EB6 ≭ -P□36GΔ	36	5.305 [134.75]	5.045 [128.14]	4.625 [117.48]	4.785 [121.54]	4.625 [117.48]	.300 [7.62]
EB6 ≭ -P□40GΔ	40	5.805 [147.45]	5.545 [140.84]	5.125 [130.18]	5.285 [134.24]	5.125 [130.18]	.300 [7.62]
EB6 ≭ -P□43G∆	43	6.180 [156.97]	5.920 [150.37]	5.500 [139.70]	5.660 [143.76]	5.500 [139.70]	.300 [7.62]
EB6 ≭ -P□ 44GΔ	44	6.305 [160.15]	6.045 [153.54]	5.625 [142.88]	5.785 [146.94]	5.625 [142.88]	.300 [7.62]
EB6 ≭ -P□49GΔ	49	6.930 [176.02]	6.670 [169.42]	6.250 [158.75]	6.410 [162.81]	6.250 [158.75]	.300 [7.62]
EB6 ≭ -P□50G∆	50	7.055 [179.20]	6.795 [172.59]	6.375 [161.92]	6.535 [165.99]	6.375 [161.92]	.300 [7.62]

ORDERING INFORMATION

When ordering connectors using the above part numbers:

≭ = Indicate "4" for 150°C Burn-In Connectors, or "5" for 200°C Burn-In Connectors.

 \square = Indicate "E" for Card Extender, "K" for Wire WrapTM, or "3R" for Right Angle Terminals.

 Δ = Indicate "X" for Standard Mounting, "XF" for Flush Mounting, or "XS" for Side Mounting.

DIMENSIONAL CONFIGURATIONS FOR 150°C AND 200°C BURN-IN CONNECTORS .156" [3.96] C-C (EB7 and EB8) .090 [1.52] R TYP. .090 [1.52] R TYP. .090 [6.35] EB75 = .440 [11.18] EB85 = .460 [11.68]

MODEL -	# OF CONTACT POSITIONS	to less such a	gyt bisodegbe			_	CARD
PART NUMBER	PER SIDE	Α	В	С	D	E	DEPTH
EB8 ≭ -P□6G∆	6	1.780 [45.21]	1.531 [38.89]	1.240 [31.50]	1.100 [27.94]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□10G∆	10	2.410 [61.21]	2.156 [54.76]	1.864 [47.35]	1.724 [43.79]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□12G∆	12 8 90 .	2.720 [69.09]	2.469 [62.71]	2.176 [55.27]	2.036 [51.71]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□15G∆	15	3.190 [81.03]	2.937 [74.60]	2.644 [67.16]	2.504 [63.60]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□18G∆	18	3.660 [92.96]	3.406 [86.51]	3.112 [79.04]	2.972 [75.49]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□22G∆	22	4.280 [108.71]	4.031 [102.39]	3.736 [94.89]	3.596 [91.34]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□24G∆	24	4.590 [116.59]	4.344 [110.34]	4.051 [102.90]	3.911 [99.34]	.340 [8.64]	.330 [8.38]
EB8 ≭ -P□25G∆	25	4.750 [120.65]	4.500 [114.30]	4.207 [106.86]	4.067 [103.30]	.340 [8.64]	.330 [8.38]
EB7 ≭ D-P□36G∆	36	6.530 [165.86]	6.219 [157.96]	5.906 [150.01]	5.778 [146.76]	.438 [11.13]	.260 [6.60]
EB7 ≭ D-P□43G∆	43	7.615 [193.42]	7.302 [185.47]	7.000 [177.80]	6.802 [172.77]	.500 [12.70]	.260 [6.60]
RIGHT ANGLE DI	MENSIONS	BALMAI JEMARAI		a lo iswarbritiv t	one no beautiful a	plant committee	Paradillary C
EB7 ≭ D-PR6G∆	6	1.780 [45.21]	1.531 [38.89]	1.218 [30.94]	1.100 [27.94]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR10GΔ	10	2.410 [61.21]	2.156 [54.76]	1.843 [46.81]	1.724 [43.79]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR12G∆	12	2.720 [69.09]	2.468 [62.69]	2.156 [54.76]	2.036 [51.71]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR15G∆	15	3.190 [81.03]	2.937 [74.60]	2.624 [66.65]	2.504 [63.60]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR18G∆	18	3.660 [92.96]	3.406 [86.51]	3.093 [78.56]	2.972 [75.49]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR22G∆	22	4.280 [108.71]	4.031 [102.39]	3.717 [94.41]	3.596 [91.34]	.328 [8.33]	.260 [6.60]
EB7 ≭ D-PR 36G∆	36	6.530 [165.86]	6.219 [157.96]	5.906 [150.01]	5.778 [146.76]	.438 [11.13]	.260 [6.60]
EB7 ≭ D-PR 43G∆	43	7.615 [193.42]	7.302 [185.47]	7.000 [177.80]	6.802 [172.77]	.500 [12.70]	.260 [6.60]

ORDERING INFORMATION

When ordering connectors using the above part numbers:

≭ = Indicate "4" for 150°C Burn-In Connectors, or "5" for 200°C Burn-In Connectors.

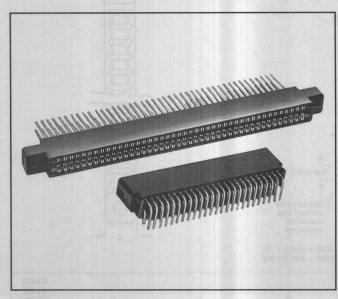
□ = Indicate "A" for Solder Eyelet, or "E" for Card Extender. Note dimensions are the same for "A" or "E" styles.

 Δ = Indicate "X" for Standard Mounting, or "XS" for Side Mounting.

MODEL EB4 Edgeboard Connectors

Dual Readout, .100" [2.54] C-C
Standard and Right Angle Terminals





ELECTRICAL SPECIFICATIONS

Current Rating: 3 amps.

Test Voltage between Contacts:

At sea level: 650 V RMS.

At 70,000 feet [21,336 meters]: 275 V RMS.

Insulation Resistance: 5000 Megohm minimum at 500

VDC potential.

Contact Resistance: 30 millivolts maximum at rated current (with gold plating).

Operating Temperature: - 65°C to + 125°C.

Humidity: 96 hours at 90% relative humidity at 40°C, dried at room temperature for 3 hours minimum, insulation resistance was greater than 5000 Megohm.

Durability: After 500 cycles of insertion and withdrawal of a .070" [1.78] thick steel test board, contact resistance less than .030V at 3 amps on gold plated contacts and individual contact pair separation force when measured with a .054" [1.37] thick steel test blade was greater than 1/2 ounce.

Shock: Three 50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

Vibration: 2 hours in each of 3 mutually perpendicular planes, frequency sweep 10 to 55 cps at .06 double amplitude with no loss of continuity.

MATERIAL SPECIFICATIONS

Body Material:

"1" glass-filled diallyl phthalate per MIL-M-14, Type SDG-F green, flame retardant (UL 94V-0).

"2" glass-filled phenolic per MIL-M-14, Type MFH dark green, flame retardant (UL 94V-0).

"3" thermoplastic polyester, glass-filled, black, flame retardant (UL 94V-0).

Contacts: Phosphor bronze. (See How to Order.)

Polarizing Key: Glass reinforced nylon, flame retardant (UL 94H-B).

(OL 3411-D).

Plating: Gold. (See How to Order.)

FEATURES

- Grid Patterns: .100" C-C x .150" [2.54 x 3.81] and .100" C-C x .200" [2.54 x 5.08]
- Standard and right angle terminals
- · Greater design latitude

3 body materials: Diallyl phthalate, phenolic and glass-filled polyester

7 contact termination styles - 3 Standard, 4 Right Angle 20 body sizes and 6 mounting styles

- Selective gold plating
- Accepts P. C. board thickness of .054" .071" [1.37 1.80]
- Polarization between contact positions in all sizes.
 Between contact polarization permits polarizing without loss of contact position.
- Recognized under the Component Program of Underwriters Laboratories Inc. Listed under File E65524, Project 77CH3889.

APPLICATIONS

For use with .0625" [1.59] printed circuit boards requiring an edgeboard type connector on .100" [2.54] centers.

PHYSICAL SPECIFICATIONS

Contact Type: Bifurcated Cantilever Beam.

Number of Contacts: 10, 12, 15, 18, 20, 22, 25, 28, 30, 31, 35, 36, 40, 43, 44, 48, 49, 50, 60 and 65 per side.

Contact Terminal Variation: Standard Terminals.

Type "C" - Dip Solder, .025" [.635] square terminals,

.175" [4.44] nominal terminal length below standoffs. **Type "D"** - Dip Solder, .025" [.635] square terminals, .115" [2.92] nominal terminal length below standoffs.

Type "K" - Wire Wrap™, .025" [.635] square terminals, .570" [14.48] nominal terminal length below standoffs.

Contact Terminal Variation: Right Angle Terminals.

Type "1R" - Dip Solder, .025" [.635] square terminals,
.120" [3.05] nominal terminal length x .150" [3.81] nominal terminal row spacing.

Type "2R" - Dip Solder, .025" [.635] square terminals, .120" [3.05] nominal terminal length x .200" [5.08] nominal terminal row spacing.

Type "3R" - Dip Solder, .025" [.635] square terminals, .180" [4.57] nominal terminal length x .150" [3.81] nominal terminal row spacing.

Type "4R" - Dip Solder, .025" [.635] square terminals, .180" [4.57] nominal terminal length x .200" [5.08] nominal terminal row spacing.

Contact Spacing: .100" [2.54] center to center.

Contact Terminal Row Spacing:

Standard - .200" [5.08] nominal.

Right Angle - .200" [5.08] nominal and .150" [3.81] nominal.

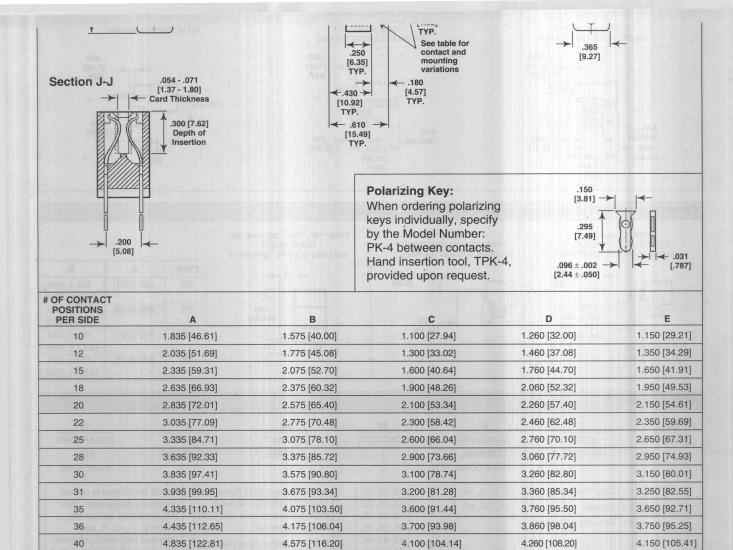
Card Thickness: .054" to .071" [1.37 to 1.80].

Card Slot Depth: .300" [7.62].

Connector Polarization: Between contact polarization key(s) are located to the right of the contact position(s) designated.

High temperature burn-in, edgeboard connectors, with .100" [2.54] center to center are on page 272 of this catalog.

[Numbers in brackets indicate millimeters]



4.875 [123.82]

4.975 [126.36]

5.375 [136.52]

5.475 [139.06]

5.575 [141.60]

6.575 [167.00]

7.075 [179.70]

43

44

48

49

50

60

65

5.135 [130.43]

5.235 [132.97]

5.635 [143.13]

5.735 [145.67]

5.835 [148.21]

6.835 [173.61]

7.335 [186.31]

4.400 [111.76]

4.500 [114.30]

4.900 [124.46]

5.000 [127.00]

5.100 [129.54]

6.100 [154.94]

6.600 [167.64]

4.450 [113.03]

4.550 [115.57]

4.950 [125.73]

5.050 [128.27]

5.150 [130.81]

6.150 [156.21]

6.650 [168.91]

4.560 [115.82]

4.660 [118.36]

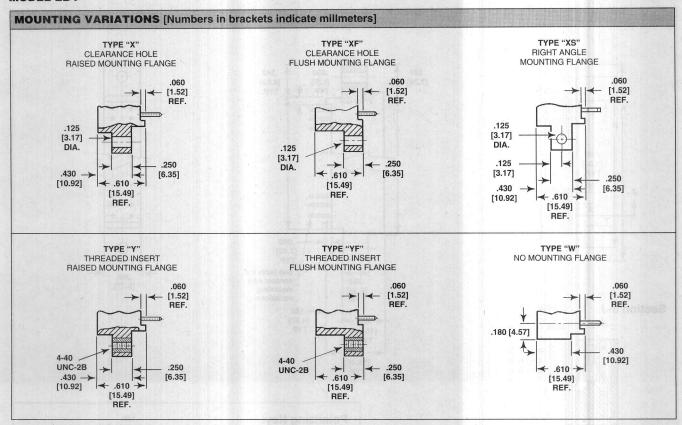
5.060 [128.52]

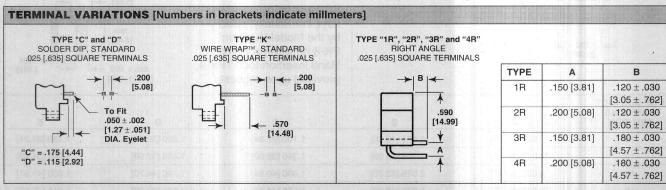
5.160 [131.06]

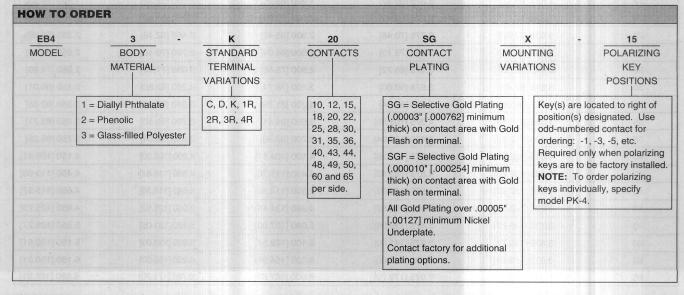
5.260 [133.60]

6.260 [159.00]

6.760 [171.70]



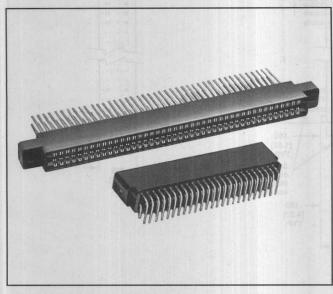




MODEL EB6 Edgeboard Connectors

Dual Readout, .125" [3.17] C-C Standard and Right Angle Terminals





ELECTRICAL SPECIFICATIONS

Current Rating: 3 amps.

Test Voltage between Contacts:

At sea level: 1500 V RMS.

At 70,000 feet [21,336 meters]: 325 V RMS.

Insulation Resistance: 5000 Megohm minimum at 500

VDC potential.

Contact Resistance: 30 millivolts maximum at rated

current (with gold plating).

Operating Temperature: - 65°C to + 125°C.

Humidity: 96 hours at 90% relative humidity at 40°C, dried at room temperature for 3 hours minimum, insulation resistance was greater than 5000 Megohm.

Durability: After 500 cycles of insertion and withdrawal of a .070" [1.78] thick steel test board, contact resistance less than .030V at 3 amps on gold plated contacts and individual contact pair separation force when measured with a .054" [1.37] thick steel test blade was greater than 1/2 ounce.

Shock: Three 50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

Vibration: 2 hours in each of 3 mutually perpendicular planes, frequency sweep 10 to 55 cps at .06 double amplitude with no loss of continuity.

MATERIAL SPECIFICATIONS

Body Material:

"1" glass-filled diallyl phthalate per MIL-M-14, Type SDG-F green, flame retardant (UL 94V-0).

"2" glass-filled phenolic per MIL-M-14, Type MFH dark green, flame retardant (UL 94V-0).

"3" thermoplastic polyester, glass-filled, black, flame retardant (UL 94V-0).

Contacts: Phosphor bronze. (See How to Order.)

Polarizing Key: Glass reinforced nylon, flame retardant

(UL 94H-B).

Plating: Gold. (See How to Order.)

FEATURES

- Grid Patterns: .125" C-C x .150" [3.17 x 3.81], .125" C-C x .200" [3.17 x 5.08] and .125" C-C x .250" [3.17 x 6.35]
- · Standard and right angle terminals
- · Greater design latitude

3 body materials: Diallyl phthalate, phenolic and glass-filled polyester

7 contact termination styles - 3 Standard, 4 Right Angle 19 body sizes and 6 mounting styles

- Selective gold plating
- Accepts P. C. board thickness of .054" .071" [1.37 1.80]
- Polarization between contact positions in all sizes.
 Between contact polarization permits polarizing without loss of contact position.
- Recognized under the Component Program of Underwriters Laboratories Inc. Listed under File E65524, Project 77CH3889.

APPLICATIONS

For use with .0625" [1.59] printed circuit boards requiring an edgeboard type connector on .125" [3.17] centers.

PHYSICAL SPECIFICATIONS

Contact Type: Bifurcated Cantilever Beam.

Number of Contacts: 6, 10, 14, 15, 18, 22, 24, 25, 28, 30,

31, 32, 35, 36, 40, 43, 44, 49 and 50 per side.

Contact Terminal Variation: Standard Terminals.

Type "C" - Dip Solder, .025" [.635] square terminals,

.175" [4.44] nominal terminal length below standoffs. **Type "D"** - Dip Solder, .025" [.635] square terminals,

.115" [2.92] nominal terminal length below standoffs.

Type "K" - Wire Wrap™, .025" [.635] square terminals, .570" [14.48] nominal terminal length below standoffs.

Contact Terminal Variation: Right Angle Terminals.

Type "1R" - Dip Solder, .025" [.635] square terminals, .120" [3.05] nominal terminal length x .150" [3.81] nominal terminal row spacing.

Type "2R" - Dip Solder, .025" [.635] square terminals, .120" [3.05] nominal terminal length x .200" [5.08] nominal terminal row spacing.

Type "3R" - Dip Solder, .025" [.635] square terminals, .180" [4.57] nominal terminal length x .150" [3.81] nominal terminal row spacing.

Type "4R" - Dip Solder, .025" [.635] square terminals, .180" [4.57] nominal terminal length x .200" [5.08] nominal terminal row spacing.

Contact Spacing: .125" [3.17] center to center.

Contact Terminal Row Spacing:

Standard - .250" [6.35] nominal.

Right Angle - .200" [5.08] nominal and .150" [3.81] nominal.

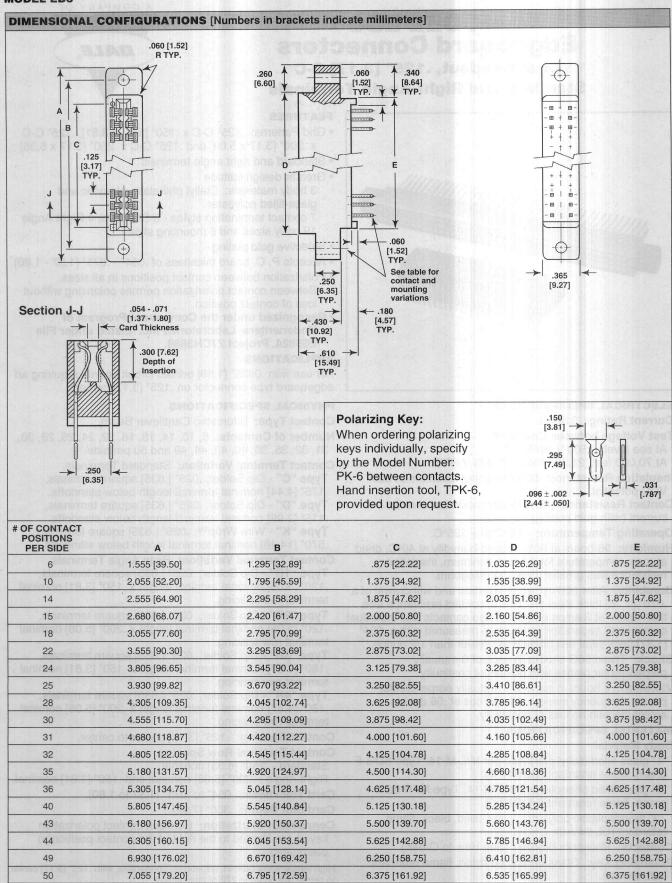
Card Thickness: .054" to .071" [1.37 to 1.80].

Card Slot Depth: .300" [7.62].

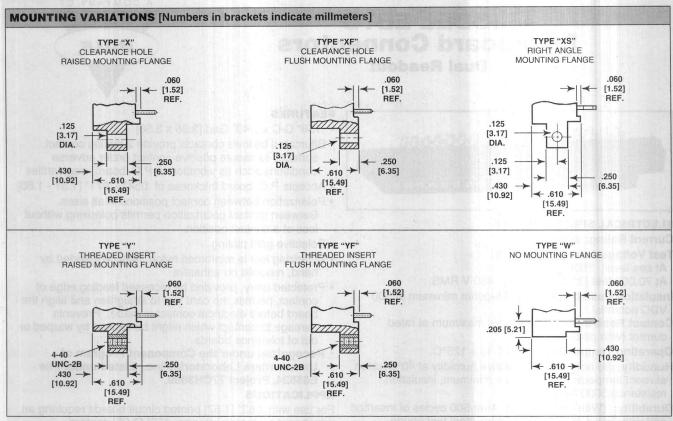
Connector Polarization: Between contact polarization key(s) are located to the right of the contact position(s) designated.

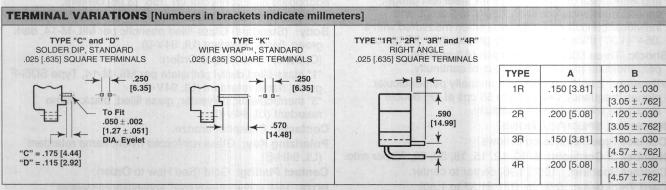
High temperature burn-in, edgeboard connectors, with .125" [3.17] center to center are on page 272 of this catalog.

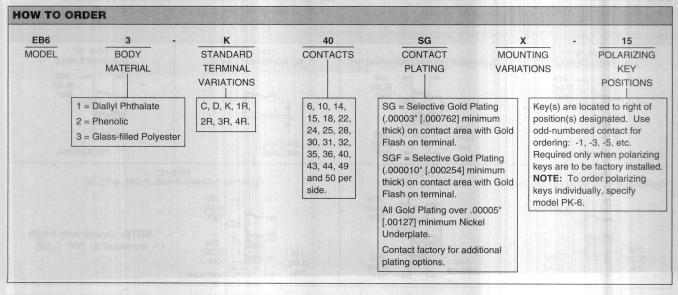
[Numbers in brackets indicate millimeters]



MODEL EB6



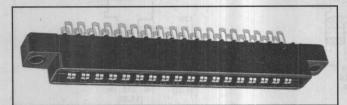




MODEL EB7D Edgeboard Connectors

Dual Readout





ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Test Voltage between Contacts:

At sea level: 1800 V RMS.

At 70,000 feet [21,336 meters]: 450 V RMS.

Insulation Resistance: 5000 Megohm minimum at 500

VDC potential.

Contact Resistance: 30 millivolts maximum at rated

current (with gold plating).

Operating Temperature: - 55°C to + 125°C.

Humidity: 96 hours at 90% relative humidity at 40°C, dried at room temperature for 3 hours minimum, insulation

resistance 5000 Megohm.

Durability: (With gold plating.) After 500 cycles of insertion and withdrawal of .070" [1.78] thick steel test gauge, contact resistance less than .030 V at 5 amps and individual contact retention force when measured with a .054" [1.37] thick steel test slug greater than 1/2 ounce.

Shock: Three 50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

Vibration: 2 hours in each of 3 mutually perpendicular planes, frequency sweep 10 to 55 cps at .06 double amplitude with no loss of continuity.

PHYSICAL SPECIFICATIONS

Contact Type: Bifurcated bellows.

Number of Contacts: 6, 10, 12, 15, 18, 22, 36, 43 per side.

Contact Spacing: .156" [3.96] center to center.

Card Thickness: .054" to .071" [1.37 to 1.80].

Card Slot Depth: Dual Readout = .260" [6.60].

FEATURES

- .156" C-C x .140" Grid [3.96 x 3.56]
- Bifurcated bellows contacts provide 2 flexing contact surfaces to assure positive contact under adverse conditions such as vibration or P.C. board irregularities
- Accepts P.C. board thickness of .054" .071" [1.37 1.80]
- Polarization between contact positions in all sizes.
 Between contact polarization permits polarizing without loss of a contact position.
- · Selective gold plating
- Polarizing key is reinforced nylon, may be inserted by hand, requires no adhesive
- Protected entry, provided by recessed leading edge of contact, permits the card slot to straighten and align the board before electrical contact is made. Prevents damage to contact which might be caused by warped or out of tolerance boards.
- Recognized under the Component Program of Underwriters Laboratories Inc. Listed under File E65524, Project 77CH3889.

APPLICATIONS

For use with .062" [1.57] printed circuit boards requiring an edgeboard type connector on .156" [3.96] centers.

MATERIAL SPECIFICATIONS

Body: (Standard) Glass-filled phenolic per MIL-M-14, dark green, flame retardant (UL 94V-0).

(Optional - See How to Order):

"1" glass-filled diallyl phthalate per MIL-M-14, Type SDG-F green, flame retardant (UL 94V-0).

"3" thermoplastic polyester, glass filled, black, flame retardant (UL 94V-0).

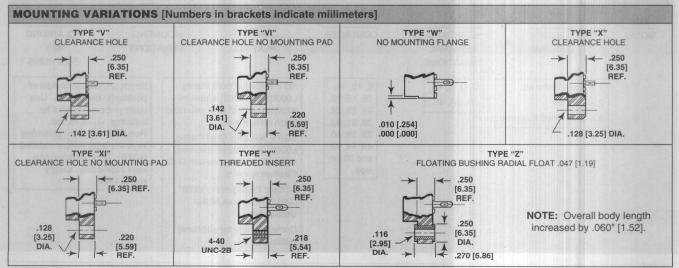
Contacts: Phosphor bronze.

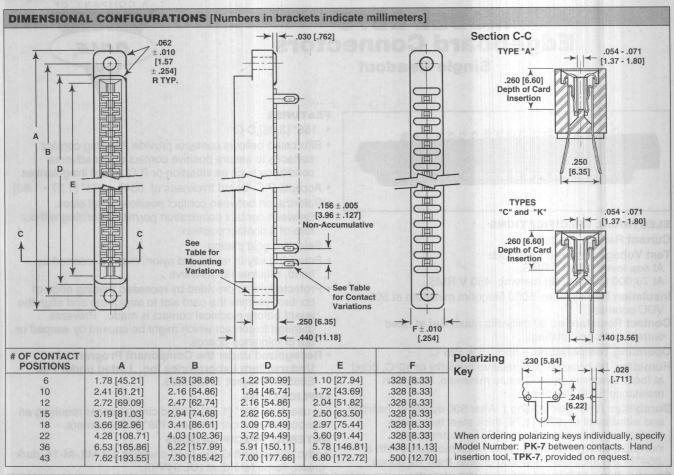
Polarizing Key: Glass reinforced nylon, flame retardant

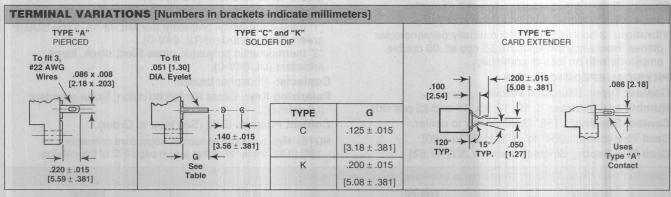
(UL 94H-B).

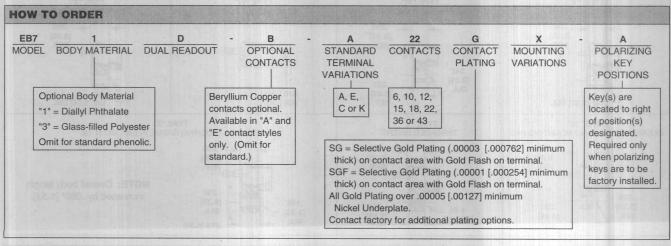
Contact Plating: Gold (See How to Order).

NOTE: High temperature burn-in, edgeboard connectors, .156" [3.96] center to center are on page 272 of this catalog.





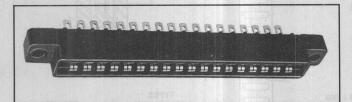




MODEL EB7S Edgeboard Connectors

Single Readout





ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Test Voltage between Contacts:

At sea level: 1800 V RMS.

At 70,000 feet [21,336 meters]: 450 V RMS.

Insulation Resistance: 5000 Megohm minimum at 500

VDC potential.

Contact Resistance: 30 millivolts maximum at rated

current (with gold plating).

Operating Temperature: - 55°C to + 125°C.

Humidity: 96 hours at 90% relative humidity at 40°C, dried at room temperature for 3 hours minimum, insulation

resistance 5000 Megohm.

Durability: (With gold plating.) After 500 cycles of insertion and withdrawal of .070" [1.78] thick steel test gauge, contact resistance less than .030 V at 5 amps and individual contact retention force when measured with a .054" [1.37] thick steel test slug greater than 1/2 ounce.

Shock: Three 50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

Vibration: 2 hours in each of 3 mutually perpendicular planes, frequency sweep 10 to 55 cps at .06 double amplitude with no loss of continuity.

PHYSICAL SPECIFICATIONS

Contact Type: Bifurcated bellows.

Number of Contacts: 6, 10, 12, 15, 18 and 22 per side.

Contact Spacing: .156" [3.96] center to center.
Card Thickness: .054" to .071" [1.37 to 1.80].
Card Slot Depth: Single Readout = .300" [7.62].

FEATURES

- · .156" [3.96] C-C
- Bifurcated bellows contacts provide 2 flexing contact surfaces to assure positive contact under adverse conditions such as vibration or P.C. board irregularities
- Accepts P.C. board thickness of .054" .071" [1.37 1.80]
- Polarization between contact positions in all sizes.
 Between contact polarization permits polarizing without loss of a contact position.
- Selective gold plating
- Polarizing key is reinforced nylon, may be inserted by hand, requires no adhesive
- Protected entry, provided by recessed leading edge of contact, permits the card slot to straighten and align the board before electrical contact is made. Prevents damage to contact which might be caused by warped or out of tolerance boards.
- Recognized under the Component Program of Underwriters Laboratories Inc. Listed under File E65524, Project 77CH3889.

APPLICATIONS

For use with .062" [1.57] printed circuit boards requiring an edgeboard type connector on .156" [3.96] centers.

MATERIAL SPECIFICATIONS

Body: (Standard) Glass-filled phenolic per MIL-M-14, dark green, flame retardant (UL 94V-0).

(Optional - See How to Order):

"1" glass-filled diallyl phthalate per MIL-M-14, Type SDG-F green, flame retardant (UL 94V-0).

"3" thermoplastic polyester, glass filled, black, flame

retardant (UL 94V-0).

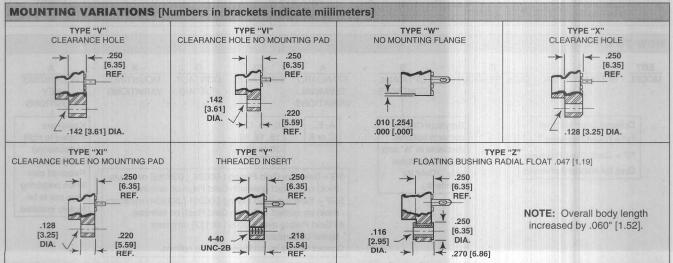
Contacts: Phosphor bronze.

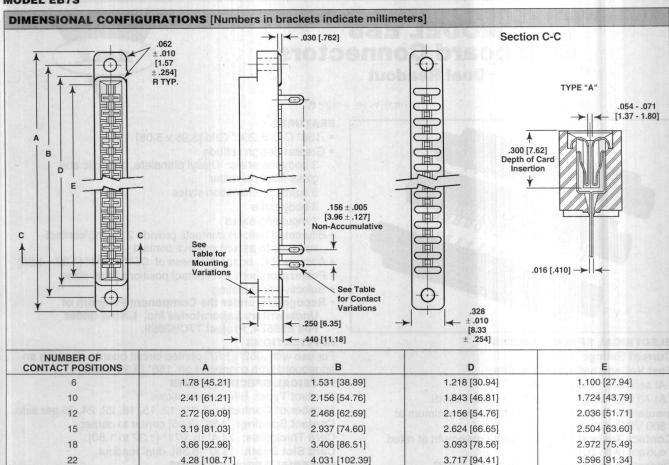
Polarizing Key: Glass reinforced nylon, flame retardant

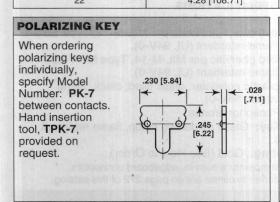
(UL 94H-B).

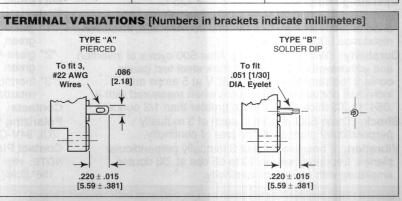
Contact Plating: Gold (See How to Order).

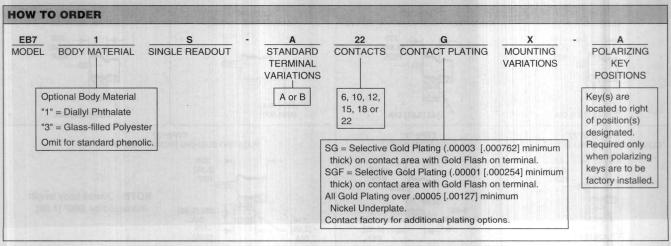
NOTE: High temperature burn-in, edgeboard connectors, .156" [3.96] center to center are on page 272 of this catalog.







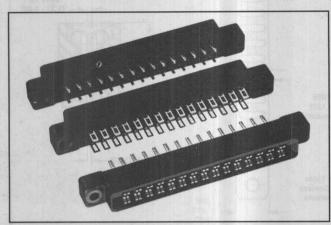




MODEL EB8 Edgeboard Connectors

Dual Readout





ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Test Voltage between Contacts:

At sea level: 1800 V RMS.

At 70,000 feet [21,336 meters]: 450 V RMS.

Insulation Resistance: 5000 Megohm minimum at

500 VDC potential.

Contact Resistance: 30 millivolts maximum at rated

current (with gold plating).

Operating Temperature: - 55°C to + 125°C.

Humidity: 96 hours at 90% relative humidity at 40°C, dried at room temperature for 3 hours minimum, insulation

resistance 5000 Megohm.

Durability: (With gold plating.) After 500 cycles of insertion and withdrawal of .070" [1.78] thick steel test gauge, contact resistance less than .030 V at 5 amps and individual contact retention force when measured with a .054" [1.37] thick steel test pin greater than 1/2 ounce.

Shock: Three 50G shocks in each of 3 mutually perpendicular planes with no loss of continuity.

Vibration: 2 hours in each of 3 mutually perpendicular planes, frequency sweep 10 to 55 cps at .06 double amplitude with no loss of continuity.

FEATURES

- .156" C-C x .200" Grid [3.96 x 5.08]
- Greater design latitude
- 3 body materials: Diallyl phthalate, phenolic and glass-filled polyester
 - 6 contact termination styles
- 8 body sizes
- 7 mounting styles
- Bifurcated bellows contacts provide 2 flexing contact surfaces to assure positive contact
- Accepts P.C. board thickness of .054" .071" [1.37 1.80]
- Polarization between contact positions in all sizes
- Selective gold plating
- Recognized under the Component Program of Underwriters Laboratories Inc. Listed under File E65524, Project 77CH3889.

APPLICATIONS

For use with .062" [1.57] printed circuit boards requiring an edgeboard type connector on .156" [3.96] centers.

PHYSICAL SPECIFICATIONS

Contact Type: Bifurcated bellows.

Number of Contacts: 6, 10, 12, 15, 18, 22, 24, 25 per side.

Contact Spacing: .156" [3.96] center to center. Card Thickness: .054" to .071" [1.37 to 1.80]. Card Slot Depth: .330" [8.38], dual readout.

MATERIAL SPECIFICATIONS

Body:

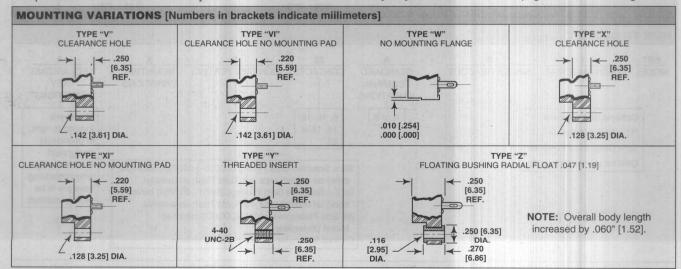
- "1" glass-filled diallyl phthalate per MIL-M-14, Type SDG-F green, flame retardant (UL 94V-0).
- "2" glass-filled phenolic per MIL-M-14, Type MFH dark green, flame retardant (UL 94V-0).
- "3" thermoplastic polyester, glass filled, black, flame retardant (UL 94V-0).

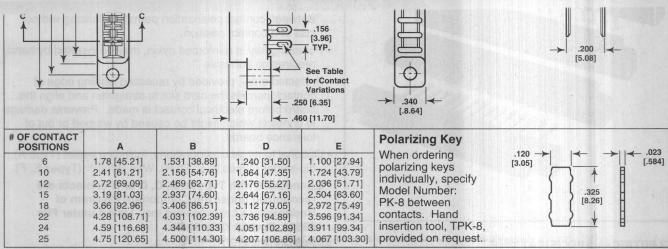
Contacts: Phosphor bronze.

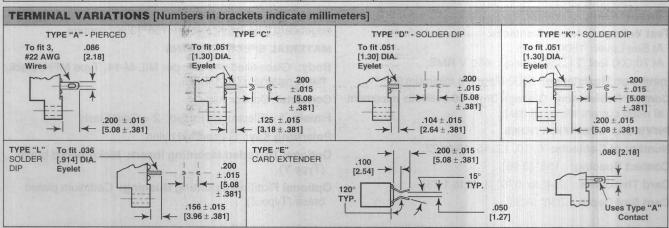
Polarizing Key: Glass reinforced nylon, flame retardant (UL 94V-O).

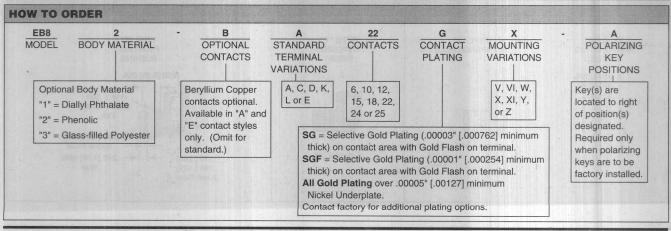
Contact Plating: Gold (See How to Order).

NOTE: High temperature burn-in, edgeboard connectors, .156" [3.96] center to center are on page 272 of this catalog.







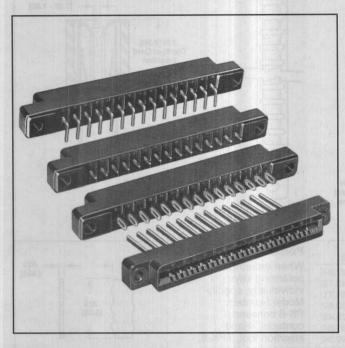


MODEL EBT156 Edgeboard Connector

Single Readout

Dip Solder, Eyelet and Wire WrapTM Termination





ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Test Voltage between Contacts: At Sea Level: 1800 V RMS.

At 70,000 feet [21,336 meters]: 450 V RMS.

Insulation Resistance: 5000 Megohm minimum.

Contact Resistance: (Voltage Drop) 30 millivolts maximum

at rated current with gold flash.

PHYSICAL SPECIFICATIONS

Number of Contacts: 6, 10, 12, 15, 18 or 22.

Contact Spacing: .156" [3.96].

Card Thickness: .054" to .070" [1.37 to 1.78].

Card Slot Depth: .330" [8.38].

FEATURES

- .156" [3.96] C-C
- Modified tuning fork contacts have chamfered lead-in to reduce wear on printed circuit board contacts without sacrificing contact pressure and wiping action.
- Accepts P.C. board thickness of .054" to .070" [1.37 to 1.78]
- Polarization on or between contact position in all sizes.
 Between contact polarization permits polarizing without loss of a contact position.
- Polarizing key is reinforced nylon, may be inserted by hand, requires no adhesive
- Protected entry, provided by recessed leading edge of contact, permits the card slot to straighten and align the board before electrical contact is made. Prevents damage to contacts which might be caused by warped or out of tolerance boards.
- Optional terminal configurations, including eyelet (Type A), dip-solder (Types B, C, D, R), Wire Wrap™ (Types E, F).
- Connectors with Type A, B, C, D or R contacts are recognized under the Component Program of Underwriters Laboratories Inc. Listed under File 65524, Project 77CH3889.

APPLICATIONS

For use with .062" [1.57] printed circuit boards requiring an edgeboard type connector on .156" [3.96] centers.

MATERIAL SPECIFICATIONS

Body: Glass-filled phenolic per MIL-M-14, Type MFH, black, flame retardant (UL 94V-0).

Contacts: Copper Alloy.

Finish: 1 = Electro Tin Plated. 2 = Gold Flash.

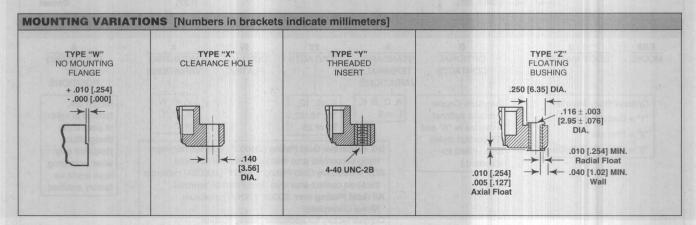
Polarizing Key: Glass-filled nylon.

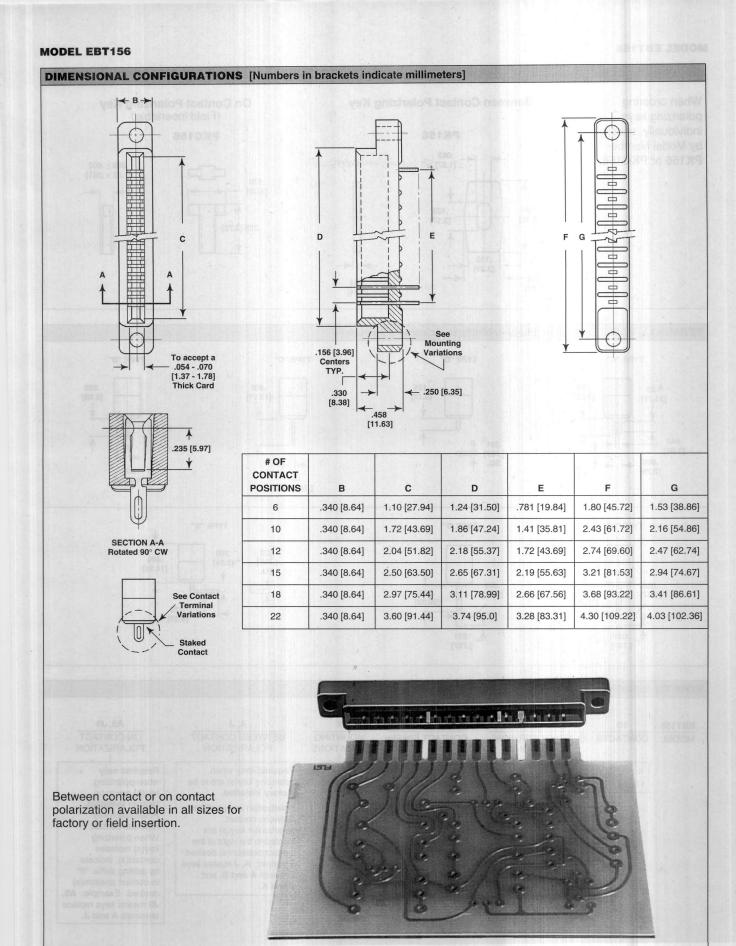
Optional Threaded Mounting Insert: Nickel plated brass

(Type Y).

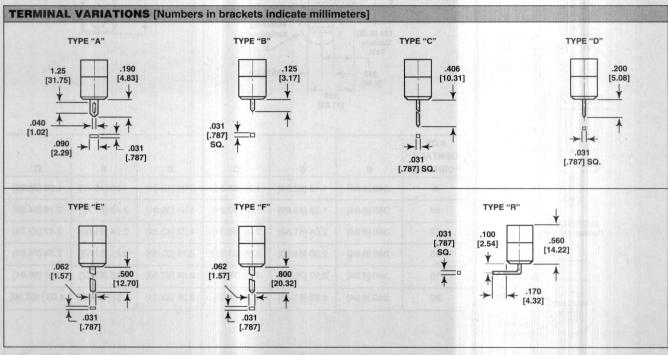
Optional Floating Mounting Bushing: Cadmium plated

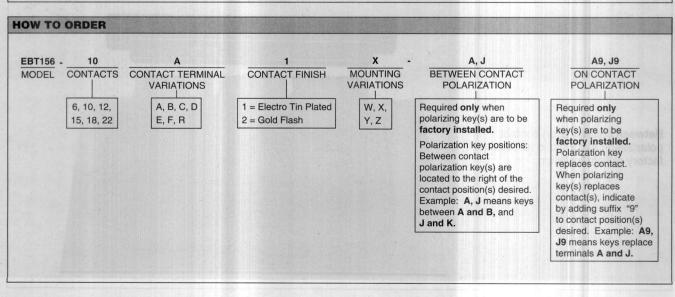
brass (Type Z).





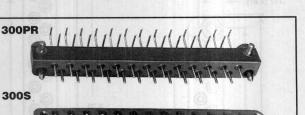
POLARIZING KEYS [Numbers in brackets indicate millimeters] **Between Contact Polarizing Key** On Contact Polarizing Key When ordering (Field insertable) polarizing keys individually, specify PK156 **PKC156** by Model Number PK156 or PKC156. .060 ± .002 $[1.52 \pm .051]$.170 [4.32] .328 .125 [3.17] .225 [5.72] .150 .180 .034 [4.57] [.864]





MODEL 300 Printed Circuit Board Connectors Dip Solder





ELECTRICAL SPECIFICATIONS

Current Rating: 7.5 amps.

Breakdown Voltage: At Sea Level: 3600 V RMS.

At 70,000 feet: 975 V RMS.

MATERIAL SPECIFICATIONS

Contact Pin: Phosphor Bronze.
Contact Socket: Phosphor Bronze.
Contact Plating: Gold Plated.

Guide Pins: Stainless steel, passivated.

Body: (Standard) Glass-filled diallyl phthalate per MIL-M-14, Type GDI-30F, green. Other body material available.

FEATURES

- · Right angle or straight through dip solder terminals
- Threaded mounting studs
- · Male contacts molded in
- Mating connector has solder cup or dip solder terminals
- · Permanent mounting provides greater reliability
- Female contacts float to aid in alignment and resist vibration
- Polarization provided by contact arrangement and guide pin location

APPLICATIONS

Where permanent mounting of male connector to printed circuit board is required with mating female connector available.

PHYSICAL SPECIFICATIONS

Number of Contacts: 7, 15, 19 and 25.

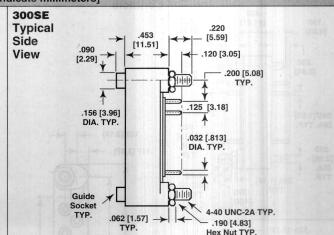
Contact Spacing: .250" [6.35] staggered rows provide

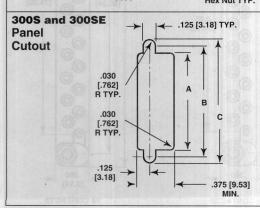
a .125" [3.18] grid.

Contact Gauge: #20 AWG.

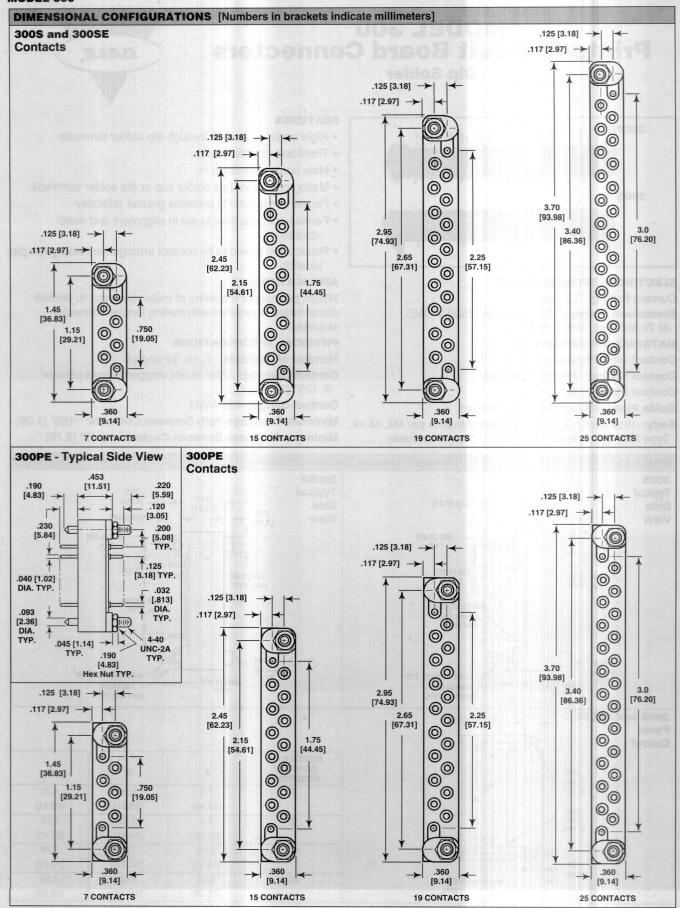
Minimum Creepage Path Between Contacts: .160" [4.06]. Minimum Air Space Between Contacts: .110" [2.79].

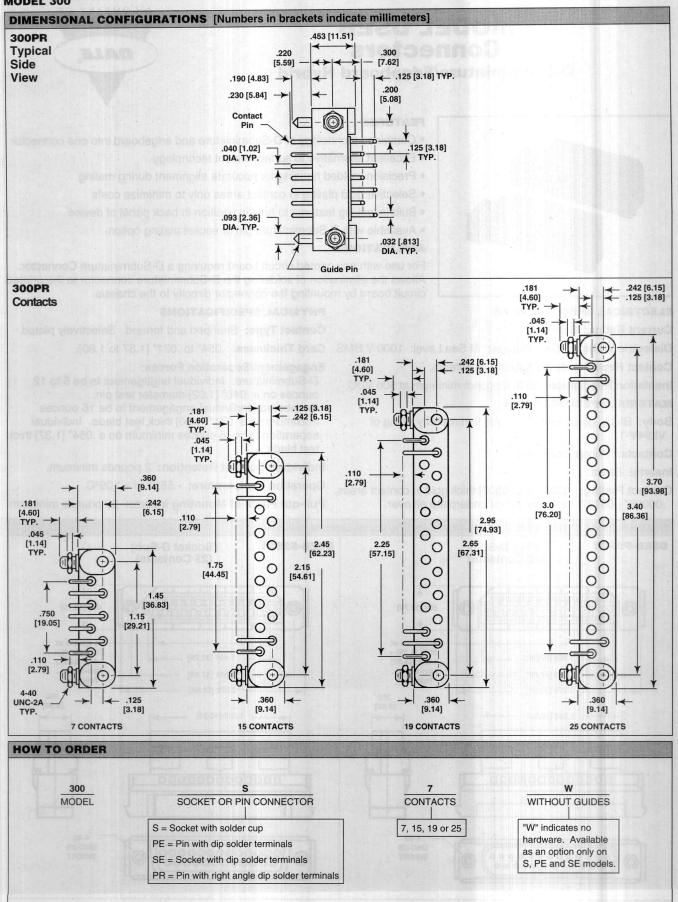
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] 3005 **Typical** [11.51] Side .310 [7.87] .090 View .200 [5.08] 111111 125 [3.18] 156 [3.96] TYP. DIA. TYP .046 [1.17] DIA. Solder Cup #20 AWG Guide Socket 4-40 UNC-2A TYP. .062 [1.57] .190 [4.83] Hex Nut TYP.





NUMBER OF CONTACT POSITIONS	A	В	С
7	1.0	1.15	1.28
	[25.40]	[29.21]	[32.51]
15	2.0	2.15	2.28
	[50.80]	[54.61]	[57.91]
19	2.50	2.65	2.78
	[63.50]	[67.31]	[70.61]
25	3.25	3.40	3.53
ATOMINGO AT	[82.55]	[86.36]	[89.66]

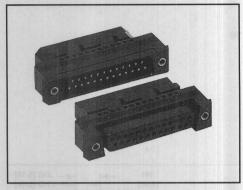




MODEL DSEB Connectors

D-Subminiature/Edgeboard Hybrid





FEATURES

- Combined technology of D-Subminiature and edgeboard into one connector
- Excellent alternative to surface mount technology
- · Precision molded housing for accurate alignment during mating
- Selective gold plating in contact areas only to minimize costs
- · Built-in locking features to hold in position in back panel of device
- Available with D-Subminiature pin or socket mating option

APPLICATIONS

For use with any printed circuit board requiring a D-Subminiature Connector. Allows the elimination of soldering the D-Subminiature connector to the printed circuit board by mounting the connector directly to the chassis.

ELECTRICAL SPECIFICATIONS

Current Rating: 5 amps.

Dielectric Withstanding Voltage: At Sea Level: 1000 V RMS. Card Thickness: .054" to .071" [1.37 to 1.80].

Contact Resistance: 15 Milliohm maximum.

Insulation Resistance: 5000 Megohm minimum at 500 VDC.

MATERIAL SPECIFICATIONS

Body: Black, glass-filled PPO with flammability rating of

VL94V-1.

Contacts: Phosphor Bronze.

Inserts: Brass.

Contact Plating: .00002" [.000508] thick gold in contact areas. .00005" [.00127] minimum nickel underplate all over.

PHYSICAL SPECIFICATIONS

Contact Type: Stamped and formed. Selectively plated.

Engagement/Separation Forces:

D-Subminiature: Individual engagement to be 5 to 12

ounces on a .040" [1.02] diameter test pin.

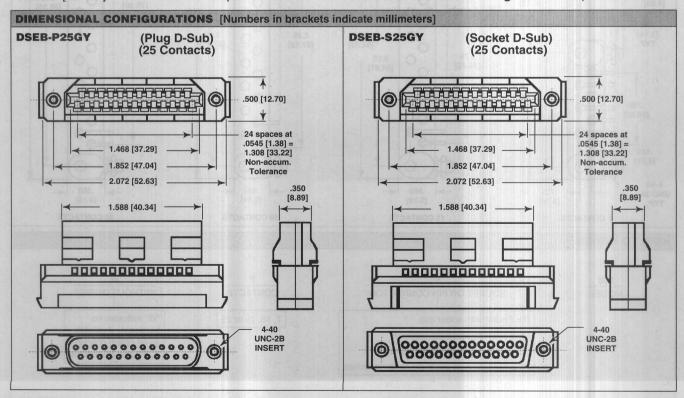
Edgeboard: Individual engagement to be 16 ounces maximum on a .071" [1.80] thick test blade. Individual separation to be .5 ounces minimum on a .054" [1.37] thick

test blade.

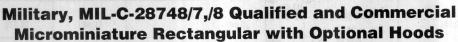
Individual Contact Retention: 2 pounds minimum.

Operation Temperature: - 55°C to + 105°C.

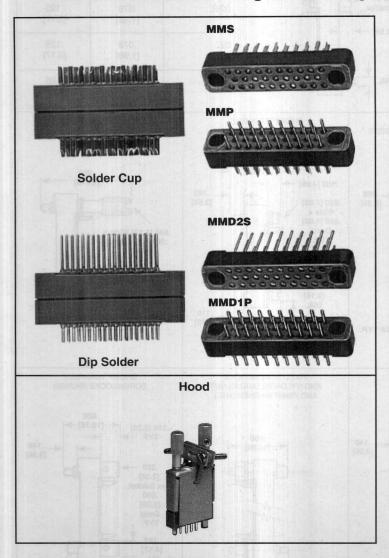
Pull-out Force of Mounting Inserts: 50 pounds minimum.



MODELS MM22 and MM24 Rack and Panel Connectors







FEATURES

- Qualified to MIL-C-28748/7,/8
- · Solder cup contacts
- · Dip solder contacts
- · Fixed and turnable screwlocks
- · Optional closed entry socket contacts

APPLICATIONS

Especially suited for use in airborne, instrumentation and portable equipment applications or wherever the following requirements must be met: Minimum space and weight without sacrifice of performance, high quality materials, long service life, high vibration and shock resistance and positive locking.

ELECTRICAL SPECIFICATIONS

Current Rating: Model MM22 = 5 amps. Model MM24 = 3 amps.

Breakdown Voltage: At Sea Level: 2000 V RMS.

At 70,000 feet: 500 V RMS.

MATERIAL SPECIFICATIONS

Contact Pin: Phosphor Bronze.
Contact Socket: Phosphor Bronze.
(Beryllium Copper available on request.)

Contact Plating: Gold.

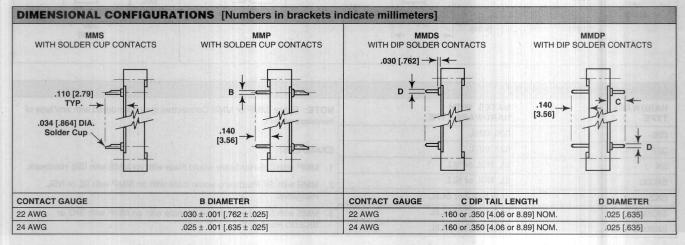
Screwlocks: Stainless steel, passivated.

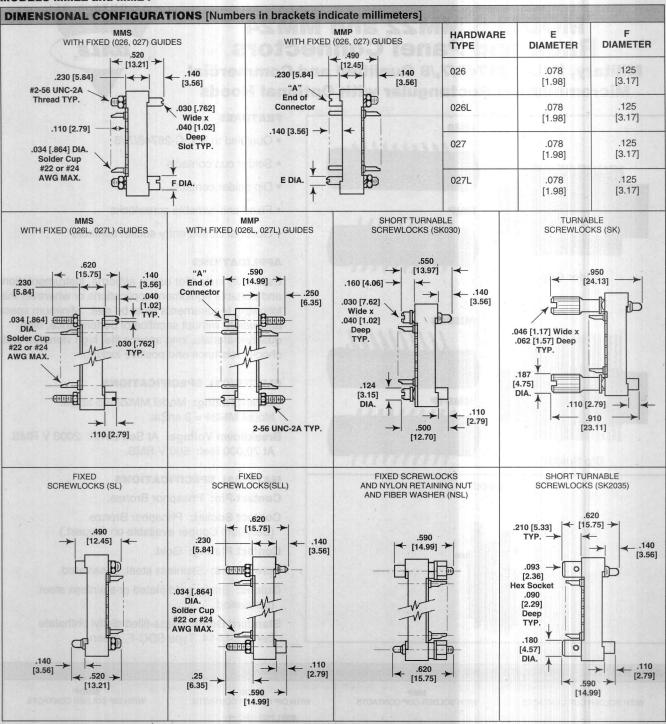
Guides: Brass, gold plated or stainless steel,

passivated.

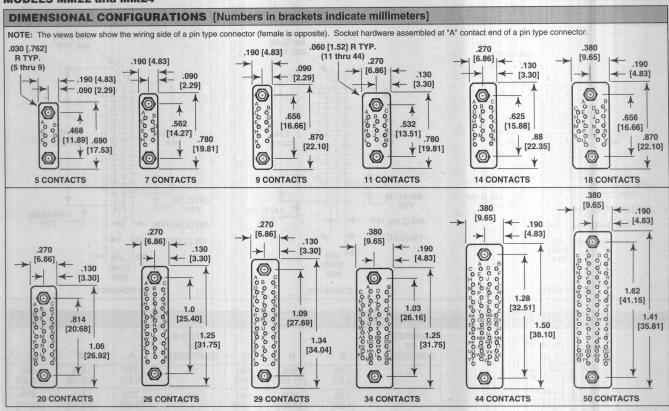
Standard Body: Glass-filled diallyl phthalate

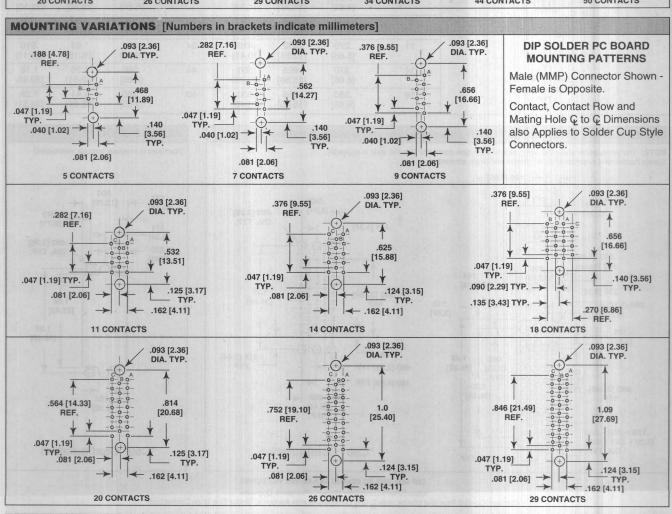
per MIL-M-14, Type SDG-F, green.

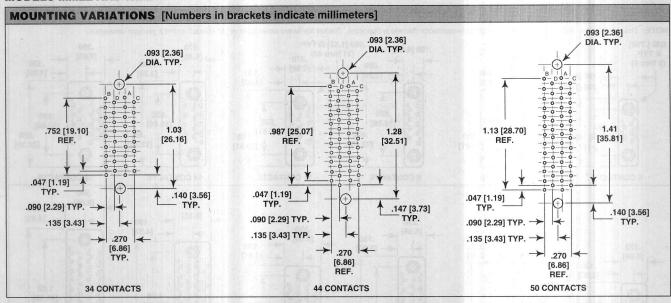




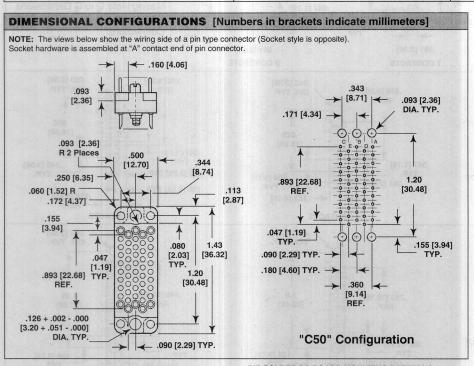
HARDWARE TYPE	MATES WITH HARDWARE TYPE	NOTE: Either MMP or MMS Connectors may be ordered with any type of hardware shown.
026	026, 026L	
027	027, 027L	EXAMPLES:
SK	SL, NSL or SLL	MMP with 026 Hardware would mate with an MMS with 026 Hardware
SK030	SL, NSL or SLL	2. MMS with SK Hardware would mate with an MMP with SL or NSL
SK2	SL2, NSL2 or SL2L	Hardware.
SK2030	SL2, NSL2 or SL2L	3. MMS with SL2 Hardware would mate with an MMP with SK2 or
SK2035	SL2, NSL2 or SL2L	SK2030 Hardware.

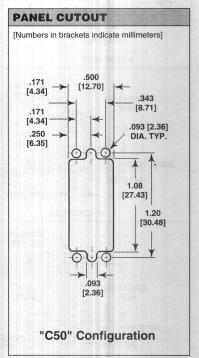






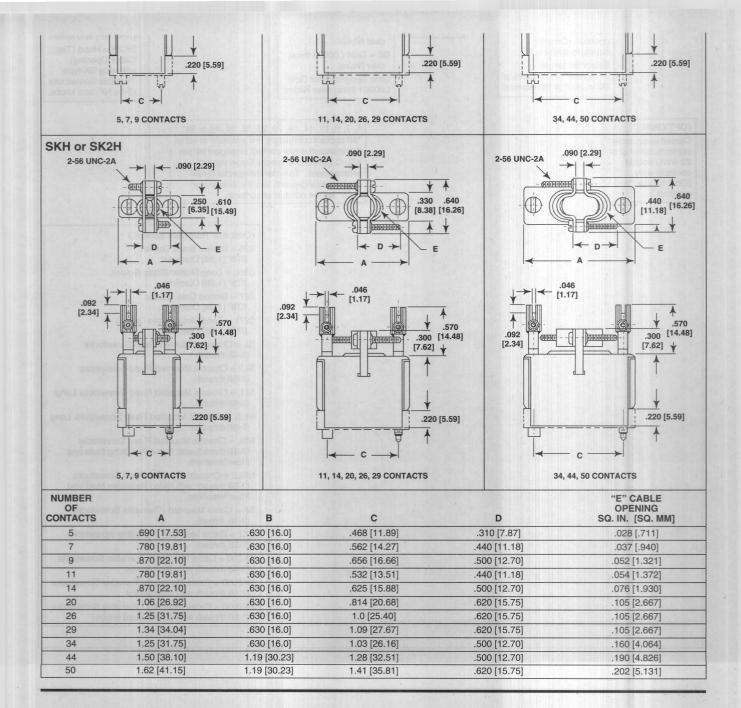
A >	NUMBER OF CONTACTS	A	В	С	NUMBER OF CONTACTS	А	В ~	С
0.050 [1.27] B C R TYP.	5	.190 [4.83]	.468 [11.89]	.340 [8.64]	20	.270 [6.86]	.814 [20.68]	.690 [17.53]
	. 7. А (ИОО А	.190 [4.83]	.562 [14.27]	.440 [11.18]	26	.270 [6.86]	1.0 [25.40]	.870 [22.10]
	9	.190 [4.83]	.656 [16.66]	.530 [13.46]	29	.270 [6.86]	1.09 [27.69]	.970 [24.64]
	11	.270 [6.86]	.532 [13.51]	.410 [10.41]	34	.380 [9.65]	1.03 [26.16]	.910 [23.11]
	14	.270 [6.86]	.625 [15.88]	.500 [12.70]	44	.380 [9.65]	1.28 [32.51]	1.16 [29.46]
.093 [2.36] TYP.	18	.380 [9.65]	.656 [16.66]	.530 [13.46]	50	.380 [9.65]	1.41 [35.81]	1.28 [32.51]

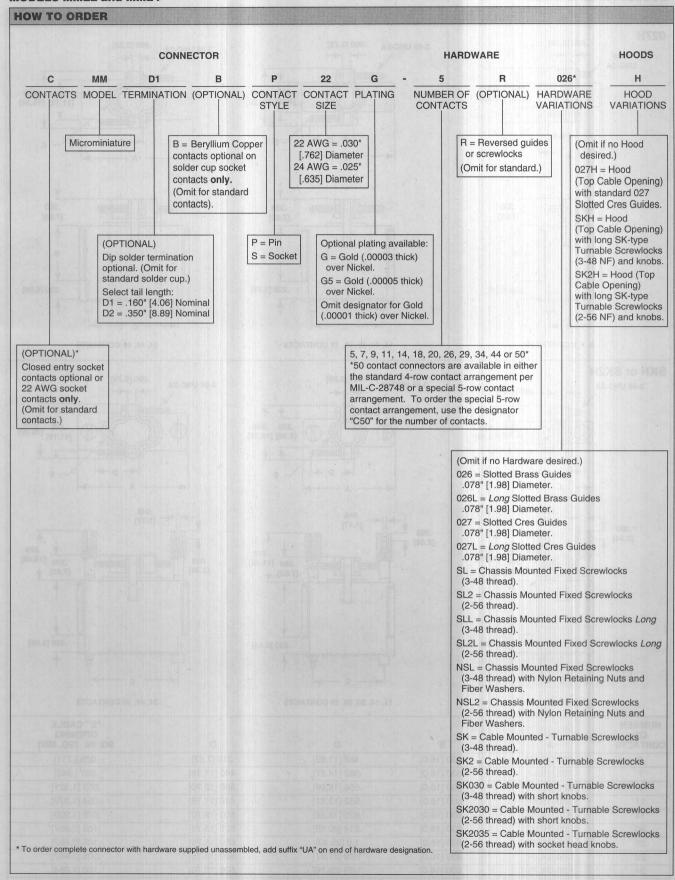




DIP SOLDER PC BOARD MOUNTING PATTERNS

Male (MMP) Connector Shown - Female is Opposite. Contact, Contact Row and Mating Hole ပု to ပု Dimensions also Applies to Solder Cup Style Connectors.

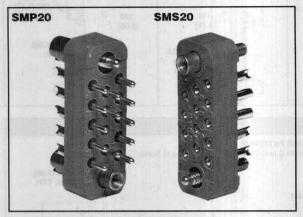




MODEL SM20 Rack and Panel Connectors

Subminiature Rectangular





ELECTRICAL SPECIFICATIONS

Current Rating: 7.5 amps.

Breakdown Voltage:

At Sea Level: 2000 V RMS.

At 70,000 feet [21,336 meters]: 500 V RMS.

PHYSICAL SPECIFICATIONS

Number of Contacts: 5, 7, 11, 14, 20, 26, 34, 42,

50, 75.

Contact Spacing: .120" [3.05]. Contact Gauge: #20 AWG.

Minimum Creepage Path Between Contacts:

.080" [2.03].

Minimum Air Space Between Contacts: .050" [1.27].

FEATURES

- Lightweight
- · Polarized by guides or screwlocks
- Screwlocks lock connectors together to withstand vibration and accidental disconnect
- · Overall height kept to a minimum
- Floating contacts aid in alignment and in withstanding vibration
- Contacts, precision machined and individually gauged, provide high reliability
- Insertion and withdrawal forces kept low without increasing contact resistance
- Contact plating provides protection against corrosion, assures low contact resistance and ease of soldering

APPLICATIONS

For use wherever space is at a premium and a high quality connector is required in avionics, automation, communications, controls, instrumentation, missiles, computers and quidance systems.

MATERIAL SPECIFICATIONS

Contact Pin: Brass, gold plated.

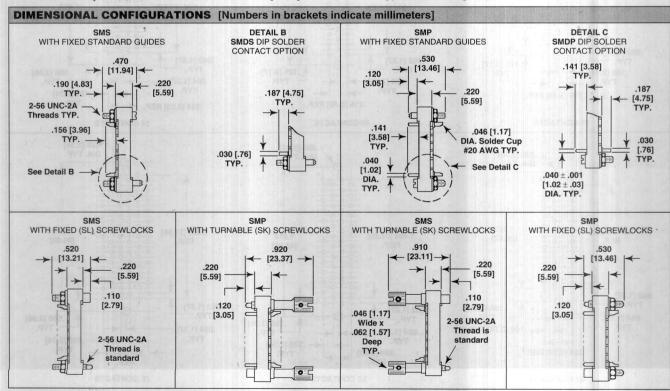
Contact Socket: Phosphor Bronze, gold plated. (Beryllium Copper available on request.)

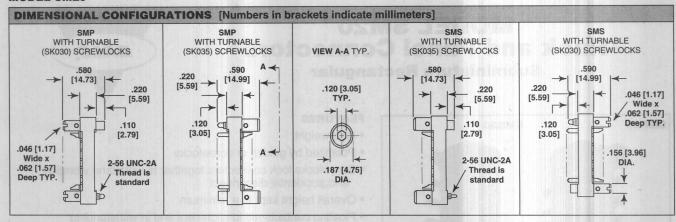
Guides: Stainless steel, passivated.

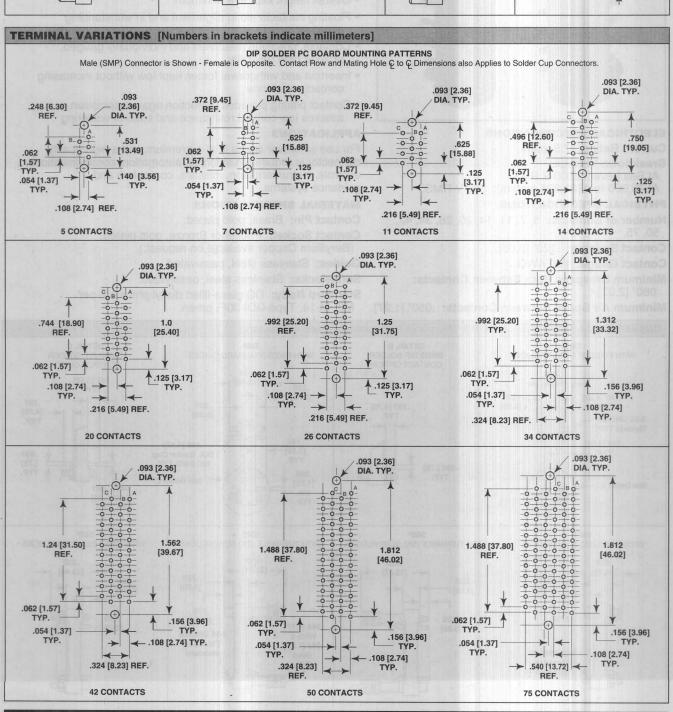
Screwlocks: Stainless steel, passivated.

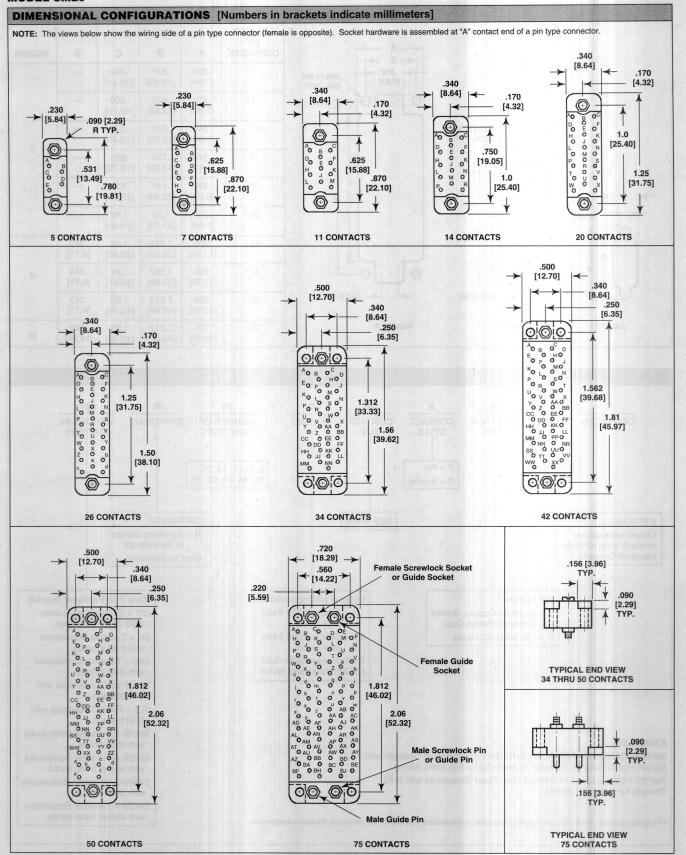
Standard Body: DG glass-filled diallyl phthalate per

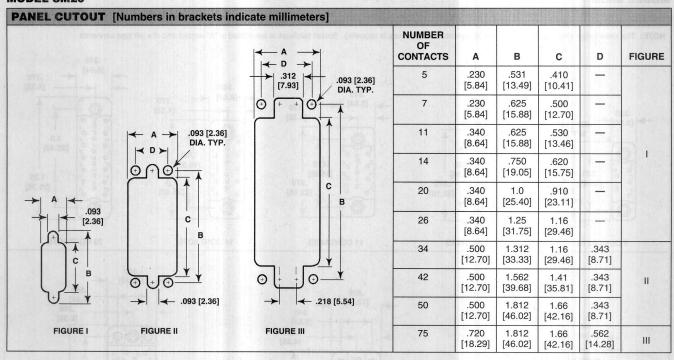
MIL-M-14, Type GDI-30F, green.

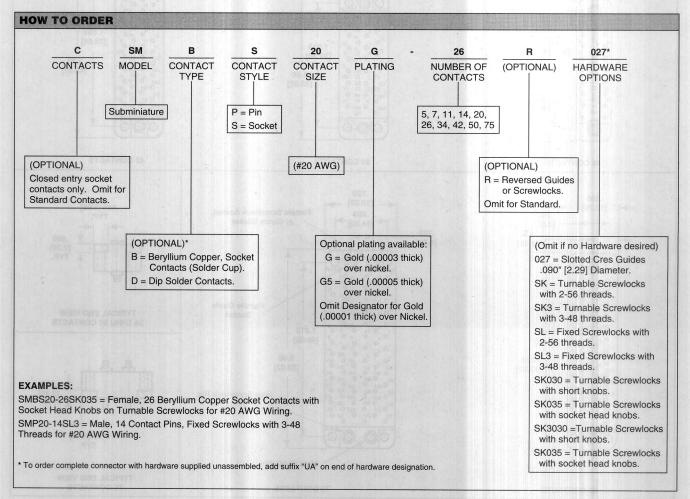












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	MODELS ED1 and ED5 Edgeboard Connectors	Dual readout edgeboard connectors. Permit custom variations in substrate length, width and number of contacts without tooling charge. Substrate lengths from 1.20" [30.48] to 4.50" [114.30] in .050" [1.27] increments. These accept .031" [.794] and .062" [1.59] substrates. From 20 through 87 contacts can be provided on .050" [1.27] centers.
Summing &	MODEL 303 Dip Solder Connectors	Right angle or straight-through terminals. Series 303 has 45 staggered contacts in a compact 3-row design (.050" x .200" [1.27 x 5.08] pattern).
	MODEL 315 Dip Solder Connectors	50 contacts with .200" [5.08] spacing. Staggered rows provide a .100" [2.54] grid. Right angle or straight-through terminations. Interchangeable polarization guides can be oriented to provide 144 keying variations.
	MODELS PJ and 500SR5 Test Point Connectors	Right angle or straight-through dip solder pins for permanent mounting. Models with 1 and 5 contacts, and .150" [3.81] spacing, accept .080" [2.03] diameter probes.
	MODELS A20 and WA20 Side Mount Connectors MODELS G20 and G16 Side Mount Connectors	Body components available with any desired pin and socket combination. Floating contacts. Hole through body permits flat or building block type mounting.
	MODEL S20 Housed Connectors	Lightweight connectors. Protective housing and hood. For RF and power interconnect applications. Floating contacts withstand vibration and aid in alignment. Shell design provides polarization.
010	MODEL QX32 Umbilical Connectors	Umbilical types. QX styles designed for use in missile firing systems.

Plasma Flat Panel Displays



INTRODUCTION

Dale[®] displays are screened image DC plasma (gas discharge) displays. The neon-orange color and screened image construction combine to produce a man-machine interface that has superior ergonomics, with wide viewing angles, and high contrast over a broad range of lighting conditions.

Dale displays have a versatile range of applications including point-of-sale devices, avionics, gasoline pumps, industrial controls and measurement systems, audio equipment, medical instrumentation and programmable controllers.

To meet these needs, Dale provides a variety of models including numeric and alphanumeric segmented displays, linear bar graphs, and segmented and dot matrix modules.

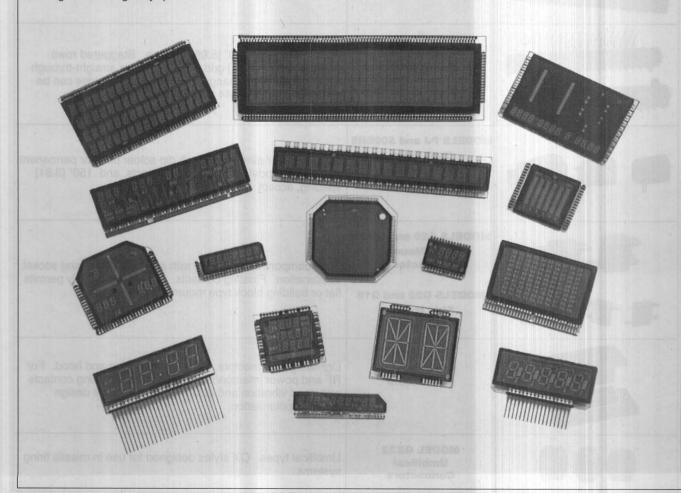
We continue to add new products and enhancements to existing models, so please contact us if your needs are not met by any of the products in this brochure.

ENGINEERING ASSISTANCE

If you would like to discuss the various design parameters and display technologies in order to choose the right display for your application, call our engineering department. They will give you an objective analysis of your options. Consideration will be given to the amount and type of information to be displayed, viewing distance, ambient lighting conditions, operating environment, power, mounting dimensions and cost. Our goal is to help you select the best display - the first time.

CUSTOM DISPLAYS

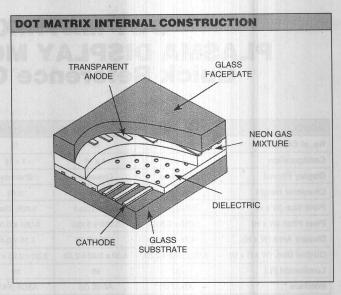
We "cut our teeth" on custom displays and continue to design and build displays that enable our customers to personalize their products. Our screened image technology allows maximum freedom to display symbols, messages and characters unique to your application - at a price you can afford. Just send us a sketch of your idea, and we'll prepare a counter drawing and a budgetary quotation.

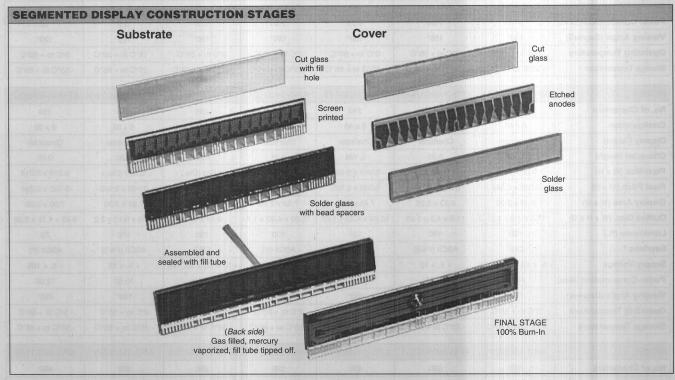


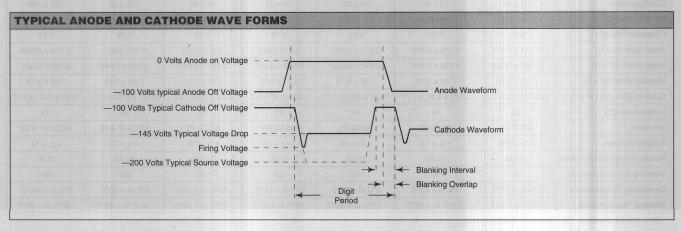
PLASMA FLAT PANEL DISPLAYS

CONSTRUCTION AND OPERATION

Dale® plasma displays share a common construction method. Cathodes are screen printed and fired on a glass substrate and then outlined with a dielectric to precisely determine the geometry of the display element. Some models have an additional circuit underneath the cathodes to allow for crossovers. The transparent tin oxide anodes on the front substrate are defined by a screen printing and etching process. The two glass substrates are placed together, but separated by a small gap, sealed and filled with a neonbased gas mixture. When an appropriate voltage and current is applied between the anode and cathode electrodes, the gas will ionize, creating an image of the cathode. All Dale displays are designed to be multiplexed to reduce the number of display connections and drivers. Several "keep-alives" are used to supply a low level ion source to ensure rapid ionization and to provide stable operation under a variety of operating conditions. Integrated circuit drivers and DC-DC high voltage converter modules are readily available to facilitate your circuit design.







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Outline Dim. (W x H x D)	8.00 x 3.48 x 2.33	8.00 x 3.48 x 2.33	8.50 x 2.25 x 1.96	8.50 x 2.25 x 0.98	6.25 x 3.00 x 1.75	4.62 x 4.72 x 3.75	6.0 x 4.5 x 1.95
Luminance (fL)	80	80	80	60	80	80	70
Interface *	ASCII (P)	ASCII (S)	ASCII (P&S)	Special	ASCII (S)	ASCII (S)	ASCII (S)
Supply Voltage	+ 5, + 185	+ 5	5.0	+ 5, + 250	+ 5	+ 5, + 12	+ 5
Power Consumption (Max)	6.45	7.50	6.25	9.90	5.00	8.5	12
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	120°	120°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

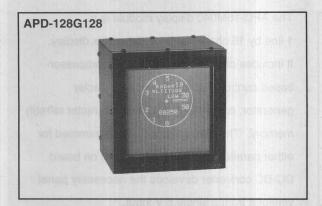
MODEL	APD-240M026A	APD-240M026A-1	APD-240M019	APD-240M021	APD-256M026	APD-256M026-1	APD-256M025A
No. of Characters	240	240	240	240	256	256	256
Configuration	6 x 40	6 x 40	6 x 40	6 x 40	8 x 32	8 x 32	8 x 32
Display Format	Character	Character	Character	Character	Character	Character	Character
Character Height	0.26	0.26	0.196	0.21	0.26	0.26	0.25
Pixel Size (W x H)	0.020 (Dia.)	0.020 (Dia.)	0.019 x 0.019	0.018 (Dia.)	0.020 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.030 x 0.040	0.030 x 0.040	0.030 x 0.030	0.032 x 0.032	0.040 x 0.040	0.040 x 0.040	0.032 x 0.039
Display Area (W x H)	8.33 x 2.26	8.33 x 2.26	7.43 x 1.83	7.52 x 2.15	7.62 x 3.30	7.62 x 3.30	7.00 x 3.05
Outline Dim. (W x H x D)	11.0 x 4.3 x 1.21	11.0 x 4.3 x 1.91	10.63 x 4.33 x 1.85	10.00 x 4.30 x 1.7	9.15 x 6.10	11.0 x 6.10 x 2.2	9.45 x 4.72 x 2.28
Luminance (fL)	100	100	100	100	100	100	70
Interface *	CRT	ASCII (P&S)	ASCII (S)	ASCII (P)	CRT	ASCII (P&S)	ASCII (P)
Supply Voltage	+ 5, + 12, + 65, - 115	+ 5, + 12	+ 5	+ 5, + 12 to + 30	+ 5, + 12, + 95, - 90	+ 5, + 12	+ 5, + 185
Power Consumption (Max)	14.00	15.50	12.50	11.10	14.00	15.50	12.00
Viewing Angle (Degrees)	150°	150°	150°	150°	150°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 5°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

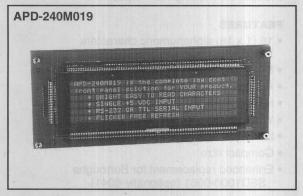
MODEL	APD-480M021	APD-480M021-1	APD-480M021-2	APD-336M019	APD-336M019-2	APD-192G088	APD-240G120
No. of Characters	480	480	480	336	336	352	480
Configuration	12 x 40	12 x 40	12 x 40	14 x 24	14 x 24	192 x 88	240 x 120
Display Format	Character	Character	Character	Character	Character	Graphics	Graphics
Character Height	0.21	0.21	0.21	0.19	0.19	0.26	0.21
Pixel Size (W x H)	0.018 x 0.018	0.018 x 0.018	0.018 x 0.018	0.013 (Dia.)	0.013 (Dia.)	0.020 (Dia.)	0.018 x 0.018
Pixel Pitch (W x H)	0.032 x 0.032	0.032 x 0.032	0.032 x 0.032	0.023 x 0.030	0.023 x 0.030	0.040 x 0.040	0.032 x 0.031
Display Area (W x H)	7.56 x 3.74	7.56 x 3.74	7.56 x 3.74	3.27 x 3.30	3.27 x 3.30	7.66 x 3.50	7.55 x 3.74
Outline Dim. (W x H x D)	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	10.87 x 5.91 x 1.77	4.40 x 4.60 x 3.0	4.40 x 4.60 x 3.0	10.87 x 6.00 x 2.25	10.87 x 5.91 x 1.77
Luminance (fL)	60	60	60	80	80	80	40
Interface *	ASCII (P)	ASCII (S)	ASCII (P)	ASCII (P)	ASCII (P)	ASCII (P & S)	ASCII (P & S)
Supply Voltage	+ 5, + 185	+ 5, + 12	+ 5, + 12	+ 5, + 15	+ 5, + 15	+ 5, + 12	+ 5, + 12
Power Consumption (Max)	10.00	12.20	12.40	10.00	10.00	15.50	13.50
Viewing Angle (Degrees)	150°	150°	150°	120°	120°	150°	150°
Operating Temperature	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	0°C to + 55°C	- 15°C to + 70°C	0°C to + 55°C	0°C to + 55°C
Storage Temperature	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C	- 55°C to + 85°C

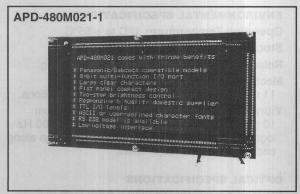
^{* (}P) = Parallel Interface. (S) = Serial (RS-232) Interface.

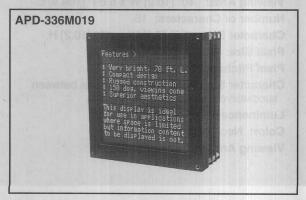
DC Plasma Display Modules











FEATURES

- Viewing Angle: Dale's[®] patented "open" construction method provides superior viewing angles that are unsurpassed by any display technology.
- Brightness: Dale displays are designed to exploit the inherent high brightness capability of DC Plasma displays to make them excellent choices for practically any application, whether it is in sunlight, brightly lit factories, or total darkness. The nature of the plasma glow make the display characters or graphics appear much larger than they actually are. The brightness is also extremely uniform since there are no internal filaments or grids that affect the light output.
- Compact Size: State-of-the-art design using the latest SMT components and DC/DC converters result in modules that provide minimum front panel space and depth.
- Flexibility: Dale excels in building display modules that allow the
 user to personalize their products at affordable prices. Our
 screened image display technology allows maximum freedom to
 design a display module that is application specific with interface
 circuitry that is synergistic to the end system.
- High Speed Data Input: Dale's creative interfaces allow high speed data input without display flickering or difficult handshaking schemes.
- Rugged Design: Shock and Vibration (non operating and operating) are no problem, as there are no fragile filaments or grids that may break.
- Made in USA: Dale Plasma display modules are completely manufactured in the USA by Dale which insures total control over all aspects of design and manufacturing to provide the utmost in customer service and support.

THE SELECTION PROCESS

- Call Dale: We have designed hundreds of application specific displays which enable us to give you an objective analysis of your needs and options.
- Type and Amount of Information to be Displayed: This will define whether a graphics or character format is required, and the minimum size of the format.
- Viewing Distance Range: This will determine the size of the characters from which the pixel pitch and size will be derived.
- Ambient Lighting Conditions: The lighting conditions will dictate
 the display luminance, whether or not dimming is required, and the
 type of contrast enhancement filter.
- Power and Voltage Available: Through the use of efficient DC/DC converters, Dale can design modules compatible with practically any power and voltage source. Dale Plasma display power requirements are competitive with any light emissive display technology.
- Overall Size: Dale is adept at designing packages to fit your space budget.
- Interface: Three basic interface levels are available:

 (1) ASCII Parallel or serial (RS-232), (2) CRT controller (user supplies sync, pixel data, and clock signals) or (3) Display glass only (Dale will gladly provide application assistance).
- Operating Environment: The operating conditions may affect the component selection and whether special packaging is required for hostile environments.

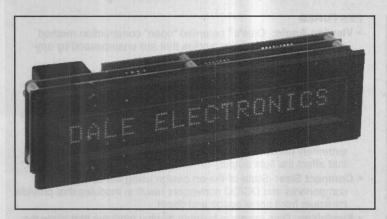
DALE'S GOAL

 To help you select the best display for your application the first time.

MODEL APD-016M040 Plasma Panel Display Modules



16 Character Display with Drive Electronics and Controller



	SYMBOL	MIN.	TYP.	MAX.	UNITS
Supply Voltage	Vcc	4.75	5.0	5.25	٧
Supply Current (1)	lcc	na zo leo	1.25	1.75	Α
Logic One Voltage	VIH	2.0		MI BISO	V
Logic Ø Voltage	VIL			.8	V

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] 8.50 [215.9] 7.15 [181.6] [17.27] 2.25 .820 [57.2] DISPLAY AREA [20.8] 720 [18.3] 156 [3.96] Mates with DALE EB81-A10GX-D 1.70 [43.2] [4.70] 1.81 [46.0] MAX 2.40 [61.0] G of Pad #1

The APD-16M040 display module is a 1 line by 16 character 5 x 7 dot matrix display. It includes drive electronics, a microprocessor-based controller consisting of a character generator, control logic and a 32 character refresh memory. The controller can be programmed for either parallel or serial interface. An on board DC-DC converter develops the necessary panel voltages from a single 5 V input.

FEATURES

- 16 (1 x 16) alphanumeric characters (5 x 7 dot matrix)
- · Bezel and filter included
- · Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- · Low input voltage
- Compact size
- Enhanced replacement for Burroughs SSD1000-0061 (optionally-0041)

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 Sine Wave,
11 ms duration, 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from
10 to 50 Hz, 2G acceleration from 50 to 2000 Hz
logarithmic sweep rate. 30 minutes duration along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: .40" [10.2] W x 6.69" [169.9] L.

Number of Characters: 16.

Character Size: .28" [7.1] W x .40" [10.2] H.

Pixel Size: .036" [.914] diameter.

Pixel Pitch: .061" [1.55].

Character Spacing: 2 blank columns between

successive characters - .147" [3.73].

Luminance: 80 foot lamberts.

Color: Neon orange. Viewing Angle: 150° cone.

MODEL APD-016M040

GENERAL DESCRIPTION

The APD-016M040 has two modes of operation, parallel or serial input. The parallel interface consists of a 6 bit data bus plus 3 hand-shaking and 3 control lines. New characters are entered from right to left by presenting the appropriate 6 bit code to the data bus and latching it into memory with a DATA PRESENT pulse. A WRITE CYCLE output signal is provided during the time in which data can be written to the display, and a DATA TAKEN pulse occurs after data has been accepted, or when BACK SPACE occurs. BACK SPACE allows the displayed message to be shifted to the right, recalling the last character shifted off the left end of the display. Up to 16 characters may be recalled, after which blanks are entered in the left position of the display. The display may be cleared at any time by bringing the CLEAR line low. A BLANK DISABLE line is provided to blank the display without altering the refresh memory contents.

The serial interface is RS-232-C compatible and has 3 selectable baud rates (300, 1200, 9600). This mode assumes 1 start bit, 8 data bits, 1 stop bit, no parity and half duplex. No handshaking is provided. Mode settings and baud rates are selected as follows. (Both lines are internally pulled to Vcc with 6.8 kilohm pull-up resistors.)

SS0	SS1	BAUD RATE
0	0	300
0	1	1200
1	0	9600
1	1	Parallel

PIN	DESCRIPTION		
PIN	DESCRIPTION	PIN	DESCRIPTION
1	DATA BIT 5	Α	DATA BIT 4
2	DATA BIT 3	В	DATA BIT 2
3	DATA BIT 1	С	DATA BIT 0
4	N/C	D	DATA PRESENT
5	CLEAR	E	BACK SPACE
6	SPEED SELECT 1	F	DATA TAKEN
7	WRITE CYCLE	н	RECEIVED DATA
8	BLANK DISABLE	J	+ 5 V
9	SPEED SELECT 0	K	N/C
10	N/C	L	GND
Keyw	ay between pins 4 (D) and	15 (E).	

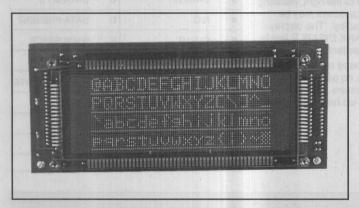
MODIFIED USASCII CHARACTER SET (Parallel Mode) (Serial Mode) Bits b7 b6 b5 . **b**5 b3 b2 b3 b2 b1 Col Row Row @ P SP SP @ Q A A Q a q В R В R b r C S BON # C S С s D Т \$ BOFF \$ D Т d t E U RST % E U е u F & F & f G W G W g w Н X Н X h BS (X) Υ i У Z J J Z Z j K K [k { L CLR < L М M = 1. m }] = N N > n { ? DEL

DESCRIPTION		PART NO.
Display and Electronics (includes Bezel) (Equivalent to Burroughs SSD1000-0061)	APD-016M040
Display and Electronics (includes Bezel) Data Entry is Left to Right (Equivalent to Burroughs SSD100	00-0041) APD-016M040-1
Mating Connector		280498-01

MODEL APD-064M033 Plasma Panel Display Modules



64 Character Display with Drive Electronics and Controller, Serial and Parallel Versions



The APD-064M033 display module displays up to) test and
64 alphanumeric 5 x 7 dot matrix characters arran	nged in
4 lines of 16 characters each. The module include	les
drive electronics, a controller consisting of refresh	1 == 0.1
memory, character generator and control logic wi	th
ASCII input. Interfacing is very simple and requir	es
minimum handshake to enable the module to ser	ve
as a cost effective direct readout device for many	
applications including POS terminals, industrial c	ontrols,
computer peripherals, measurement instruments	and
office machines. Serial and parallel versions are	
available as well as single + 5 VDC power input.	

STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V
Logic Supply Current		- I	750	mA
Panel Supply Voltage	+175	+ 185	+195	V
Panel Supply Current	0 10 0	19 _2 : 1	30	mA
(+ 5 VDC only option)				
Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V
Supply Current			1.0	A

FEATURES

- 64 (4 x 16) alpha numeric characters (5 x 7 dot matrix)
- Only + 5 and + 185 VDC required (+ 5 volt only available)
- ASCII character set (optional character sets available)
- Parallel or serial interface
- Wide viewing angle (150°)
- · Rugged design/slim profile
- Flicker free refresh, high speed data input
- High brightness
- Compatible with Babcock DP-0416-C1

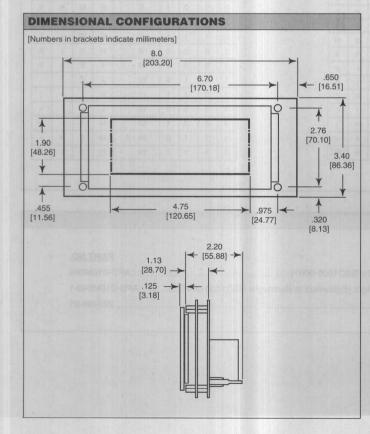
ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. **Storage Temperature:** - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.



OPTICAL SPECIFICATIONS.

Viewing Area: 4.76" [120.90] W x 2.0" [50.80] H.

Number of Characters: 64.

Character Size: .330" [8.38] W x .230" [5.84] H.

Luminance: 80 foot lamberts.

Color: Neon orange.

Viewing Angle: 150° cone.

which is entered. A single busy signal indicates to the host system when the display is busy. The logic input is one 74LS type input with a 4.75 kilohm to + 5 VDC and a 1000 pF capacitor to ground. The output is driven from a 74LS06 open collector gate and is not internally pulled up.

The serial interface is RS-232 compatible. Baud rate is 9600 (other baud rates can be supplied) and the data byte format is 8 data bits, 1 stop bit and no parity. The serial interface supports Reset, Backspace, Line Feed and Carriage Return in addition to Cursor Position selection.

INTERFACE SIGNAL DESCRIPTION

DB0-DB7 (Data bus) - Data bus to enter character and cursor data.

CUR-LD (Cursor Load) - The cursor is moved to the address given by DB0-DB7 where:

00H = home position.

0FH = last character position, 1st line.

3FH = last character position, 4th line.

WR (Write) - The ASCII character, as defined by the code given by DB0-DB7, is displayed at the selected address. The display auto-increments from a given address.

BUSY (Busy Signal) - I/O is inhibited when busy is high.

TB1	1	+ 185 VDC
	2	GROUND (L)
	3	SERIAL DATA
	4	GROUND (Data)
	5	+ 5 VDC
	6	GROUND (H)

WARNING: Wrong connections may cause permanent damage to the display and host system. When using APD-064M033-1 (+ 5 VDC only version), no connections must be made to pins 1, 2 of J2 and 1, 6 of TB1.

PARALLI	EL INPU	T FUNCTION TABLE
CUR-LD	WR	FUNCTION
L	Н	Select a cursor address with DB0-DB7
Н	L	DB0-DB7 ASCII character loaded at cursor address, increment address

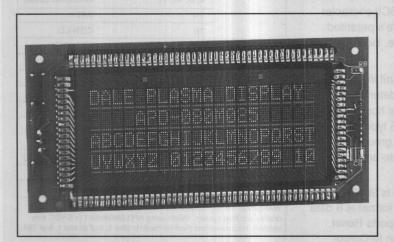
SERIAL DATA COI	NTROL CODES	Trebes
Reset	01H	No.
Backspace	08H	
Line Feed	0AH	
Carriage Return	0DH	
Load Cursor Position	1BH, XX (XX = curs	sor address)

RDERING INFORMATION	
<u>DESCRIPTION</u>	PART NUMBER
PARALLEL VERSION, + 5, + 185 VDC INPUT	
Display, Drive Electronics and Controller	APD-064M033
SERIAL VERSION, + 5 VDC INPUT, 9600 BAUD	
Display, Drive Electronics and Controller	APD-064M033-1
J1 Data Connector Kit	280105-02
J2 Power Connector Kit	
Non-Glare Filter (amber circular polarized) - other filters available, contact factory	280109-15

MODEL APD-080M025-1 Plasma Panel Display Modules







The APD-080M025-1 display module displays up to
80 alphanumeric 5 x 7 dot matrix characters
arranged in 4 lines of 20 characters each.
The module includes drive electronics, a controller
consisting of refresh memory, character generator
and control logic with an DC 000 compatible ACCII

consisting of refresh memory, character generator and control logic with an RS-232 compatible ASCII input. Interface is through a single 3 pin power connector. Baud rate is selectable from 300 to 9600. Handshaking is not required as a 20 byte FIFO buffer is used to capture data when the display is busy. Applications include POS terminals, industrial controls, computer peripherals, measurement instruments and office machines.

STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Panel Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V
Panel Supply Current	Vene -	0.3	1.0	A

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters] 6.25 [158.75] 5.75 [146.05] [6.35] 2.50 ō [63.50] Ō [37.08] 3.0 Ī [76.20] .510 [12.95] 4.03 860 6-32 [102.36] .250 [21.84] Threaded Standoffs [6.35] 4 Places \$ mm [44.45]

FEATURES

- 80 (4 x 20) alphanumeric characters (5 x 7 dot matrix) plus underbar
- Only + 5 VDC required
- ASCII character set (optional character sets available)
- Efficient serial interface (RS-232)
- Wide viewing angle (150°)
- Rugged design/slim profile
- Flicker free refresh, high speed data input
- High brightness

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: $0^{\circ}\text{C to} + 55^{\circ}\text{C}$. Storage Temperature: $-55^{\circ}\text{C to} + 85^{\circ}\text{C}$.

Relative Humidity: 10-90% R.H. non-condensing. **Mechanical Shock:** 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from

50 to 2000 Hz logarithmic sweep rate, along each

side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 4.03" [102.36] W x 1.46" [37.08] H.

Number of Characters: 80.

Character Size: .150" [3.81] W x .250" [6.35] H.

Luminance: 80 foot lamberts.

Color: Neon orange. Viewing Angle: 150° cone.

MODEL APD-080M025-1

GENERAL DESCRIPTION

The APD-080M025-1 plasma display module consists of a multiplexed DC plasma display, drive circuitry and switching voltage converter mated with an intelligent, microprocessor-based controller board. The resulting assembly interfaces easily to microprocessor based systems and only requires readily available low voltages for power. Dale's patented open construction display technology assures a stable flicker free screen even at highest communication rates.

Interfacing is very simple (and requires no handshaking as a 20 byte FIFO buffer captures data when the display is busy) through a single 3 pin connector that has + 5 VDC, SERIAL (RS-232) DATA and GROUND connections.

An EPROM based character generator is factory programmed with 96 ASCII characters. Alternate character sets can be user or factory programmed.

Serial data protocol is 1 start bit, 8 data bits and no stop bit. Baud rate (300, 1200 or 9600) is selected with a control board jumper. A simplified command set allows quick and efficient code generation.

PIN DESCRIPT	ON
PIN	SIGNAL
1 éldise	+ 5 VDC
2	SERIAL DATA
3	GROUND

COMMAND SET				
COMMAND	FUNCTION	CODE (HEX)		
Backspace	Moves cursor left	08		
Horizontal Tab	Moves cursor right	09		
Vertical Tab	Moves cursor up one line	0B		
Line Feed	Moves cursor down one line	0A		
Carriage Return	Moves cursor to start of line	0D		
Clear Screen	Screen cleared, cursor homed	0C		
Cursor Home	Moves cursor to home position	0E		
Position Cursor	Moves cursor to X-Y coord.	0F		
Cursor Address		##		
Cursor On	Cursor visible	06		
Cursor Off	Cursor invisible	07		
NOTE: All codes are in	hexadecimal.			

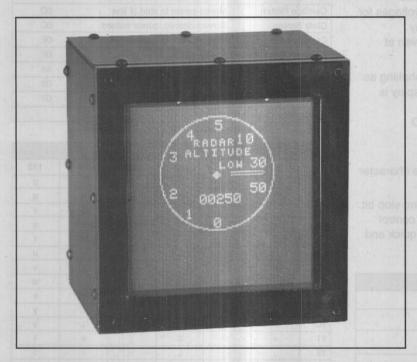
ASCII CHARACTER SET						
WATE !	32	48	64	80	96	112
0	SP	0	@	Р	•	р
1	1	1	Α	Q	a	q
2	II .	2	В	R	b	r
3	#	3	С	S	С	s
4	\$	4	D	Т	d	t
5	%	5	E	U	е	u
6	&	6	F	V	f	٧
7	,	7	G	W	g	w
8	(8	Н	X	h	X
9)	9	1	Υ	i	У
10	551, * * *		J	Z	j	Z
11	+	;	K]	k	{
12	,	<	L	\	1	1
13		=	M] ′	m	}
14		>	N	۸	n	~
15	1	?	0	_	0	

DESCRIPTION		PART NUMBER
Display, Drive Electronics and Controller		APD-080M025-1
Mating Connector Kit		280108-01
Non-Glare Filter (amber circular polarized) - other filter	rs available - contact factory	280109-10

MODEL APD-128G128 Plasma Panel Display Modules



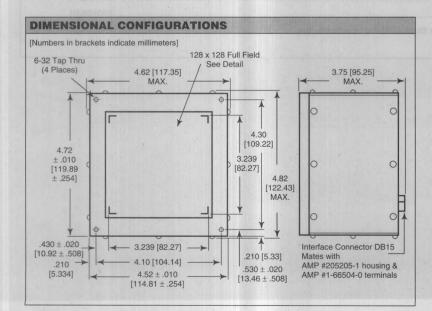




STANDARD ELECTRICAL SPECIFICATIONS				
MIN.	TYP.	MAX.	UNITS	
+ 4.75	+ 5.0	+ 5.25	V	
	250	Visit - Children	mA	
+ 11.4	+ 12.0	12.6	V	
-	0.6	1.2	А	
	MIN. + 4.75	MIN. TYP. + 4.75 + 5.0 - 250 + 11.4 + 12.0	MIN. TYP. MAX. + 4.75 + 5.0 + 5.25 — 250 — + 11.4 + 12.0 12.6	

(1) This is the input to a DC/DC converter.

There may be peak in-rush currents higher than shown.



The APD-128G128 is a full field dot matrix display with 128 columns and 128 rows. It includes drive electronics, microprocessor based controller and enclosure. The controller maintains all the refresh memory, character generation and control logic to enable the module to serve as a direct readout device for many applications including communications terminals, computer readouts and microprocessor instruments. The controller interfaces via RS-232 at 9600 baud (other baud rates are available). A DC/DC converter is also included to develop the necessary panel voltage from + 12 VDC.

FEATURES

- 128 x 128 Full field dot matrix
- Text or graphics modes

 (12 rows of 16 characters in text mode)
- · Flexible operating modes
- Serial (RS-232) interface
- · All functions software accessible
- High brightness
- Wide viewing angle
- Low input voltage
- On-board diagnostics
- Software dimming
- Minimal footprint
- Highly ruggedized

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: - 15°C to + 55°C (Life may be shortened when subjected to extended operation below 0°C).

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018 [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 3.24" [82.30] W x 3.24" [82.30] H.

Pixel Size: .015" [0.30] diameter.

Pixel Pitch: .025" [0.64].

Luminance: 60-80 foot lamberts.

Color: Neon orange.

Viewing Angle: 120° vertical, 60° horizontal.

MODEL APD-128G128

GENERAL DESCRIPTION

The APD-128G128 consists of a graphics DC plasma display panel, controller, DC/DC converter and enclosure.

The controller maintains all the refresh memory, character generation and control logic to enable the module to serve as a direct readout device for many applications including communications terminals, computer readouts and microprocessor instruments. It interfaces via RS-232 at 9600 baud.

Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling or inserting lines and characters. The character generator is a 8K x 8 bit EPROM with 256 characters consisting of 128 ASCII characters (including control codes) and 128 block graphics characters. Alternate character sets can be factory or user programmed. The dot pattern in text mode is 7 x 9 pixels in an 8 x 12 block. Two means of using graphics are supported. The first is character graphics, in which the user sends the proper ASCII code to select the desired graphics character. The character graphics mode allows easy mixing of text and graphics images. The second is the bit plot mode (using set and reset commands) which allows any graphic pattern to be drawn a bit at a time. Character entry in bit mode allows for 5 x 7 ASCII characters to be placed at any given pixel location within the pixel map.

INTERFACING

SERIAL INTERFACE

(See pin descriptions.) The controller is considered to be a DTE type device and will operate with a host that is either a DTE or DCE device. The serial input and output lines meet RS-232C specifications. Serial data is entered asynchronously with a 9600 baud. The byte format is 1 start bit, 8 data bits and 1 stop bit.

ASCII CHARACTER SET						
	32	48	64	80	96	112
0	SP	0	@	Р	11013	р
1	1	1	А	Q	a	q
2	п	2	В	R	b	omer
3	#	3	С	S	С	S
4	\$	4	D	ent.	d	t
5	%	5	E	U	е	u
6	&	6	Make DO	V	9 6 f 99	V
7	,	7	G	W	g	w
8	(100)	8	Н	X	h	x
9)	9	mootsier	Υ	epia junta	у
10	*	tells sea	J	Z	j	Z
11	ned +llive	oshijai h	К		k	{
12	sostieini l	<	asen L lower	1	ao ques	Dus II
13	The state of the state of	=	М	1	m	}
14	ini to gail	> >	N	^	n	~
15	3 10 / 30	?	0	medo gri	0	No.bes

PIN DESCRIPTION			
PIN	SIGNAL		
1	NC		
2	TRANSMIT DATA		
3	RECEIVE DATA		
4	READY TO SEND		
5	CLEAR TO SEND		
6, 7	NC		
8	+ 12 VDC		
9, 10	+ 5 VDC		
11, 12, 13	GND		
14, 15	+ 12 VDC		

CONTROL CODES	HEX	ASCII
Cursor Home	0E	CNTRL N
Carriage Return	0D	CNTRL M
Cursor Down (Line Feed)	OA	CNTRLJ
Cursor Up	0B	CNTRL K
Cursor Right	09	CNTRL I
Cursor Left	08	CNTRL H
Alter Cursor Character Position	11	CNTRL Q
Cursor Character Address (0-1F)	##	
Alter Cursor Row Position	13	CNTRLS
Cursor Row Address (0-A)	##	
Cursor On	12	CNTRL R
Cursor Off	14	CNTRLT
Alter Cursor Format	15	CNTRL U
Cursor Format Code	##	
Full Block, no blink =	00	
Blinking underbar =	01	
Underbar, no blink =	03	OUTDI O
No Operation	00	CNTRL @
Clear Screen	0C	CNTRL L
Character Insert	0F	CNTRL O
Character Delete	10	CNTRL P
Line Insert	16	CNTRL V
Line Delete	17	CNTRL W
ESCAPE CONTROL CODES		
Erase to End of Line	1B, 0D	ESC CNTRL M
Erase to End of Screen	1B, 18	ESC CNTRL X
Erase Line	1B, 13	ESC CNTRL S
Erase Line and Carriage Return	1B, 25	ESC CNTRL %
Alter Brightness	1B, 0C	ESC CNTRL L
0 = Brightest	##	
7 = Dimmest		500 ON TOL 7
Scroll	1B, 1A	ESC CNTRL Z
* End Scroll	1B, 20	ESC SPACE
Blank Display (saves screen data)	1B, 11	ESC CNTRL C
Unblank Display (restores screen)	1B, 12	ESC CNTRL R
Enter Bit Plot Mode	1B, 16	ESC CNTRL V
* Exit Bit Plot Mode	1B, 17	ESC CNTRL W
Start Confidence Test	1B, 1F	ESC, CNTRL_
* Disable Confidence Test	##	
(any code)	4D 04	
Character Blink	1B, 21	
Disable Character Blink Reset Controller (to initial state)	1B, 22 1B, 19	ESC CNTRL Y

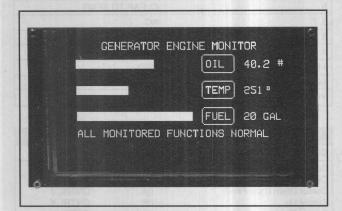
ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Display, Drive Electronics and Controller (Includes DC/DC converter)	APD-128G128
Non-Glare Filter (amber circular polarized) - other filters available - contact factory	280109-08

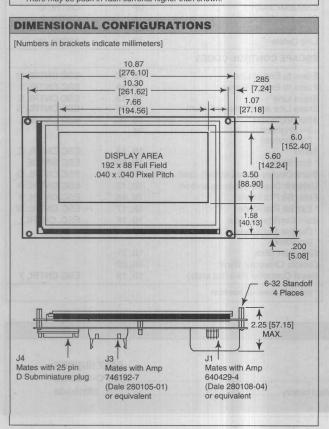
MODEL APD-192G088 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS					
MIN.	TYP.	MAX.	UNITS		
+ 4.75	+ 5.0	+ 5.25	V		
Constitution of the	700.0	<u> </u>	mA		
+ 11.4	+ 12.0	+ 12.6	٧		
ā!—	1.0	2.2	Α		
2.0			V		
10-	-	0.8	٧		
180	120-	- 0.4	mA		
	MIN. + 4.75 — + 11.4	MIN. TYP. +4.75 +5.0 - 700.0 +11.4 +12.0 - 1.0	MIN. TYP. MAX. + 4.75 + 5.0 + 5.25 — 700.0 — + 11.4 + 12.0 + 12.6 — 1.0 2.2 2.0 — — — 0.8		



The APD-192G088 is a full field dot matrix display with 192 columns and 88 rows. It includes drive electronics and a microprocessor based controller. The controller maintains all the refresh memory, character generation and control logic with parallel or serial interface and a DC to DC converter to generate the necessary panel voltage. A touch panel version is also available (APD-192G088-5).

FEATURES

- 192 x 88 full field dot matrix
- Parallel and serial interfaces
- · All functions software accessible
- · Character and bit plot graphics
- · Wide viewing angle
- High brightness
- Software dimming
- Low input voltage
- Compact size

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration,

5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.66" [194.56] x 3.50" [88.90].

Pixel Size: .020" [.508]. Pixel Pitch: .040" [1.02]. Luminance: 80 foot lamberts.

Color: Neon orange. Viewing Angle: 150° cone.

GENERAL DESCRIPTION

The APD-192G088 consists of a DC plasma graphics display panel, drive circuitry and controller.

The controller maintains all the refresh memory, character generation and control logic to enable the module to serve as a direct readout device for communications terminals, computer readouts, microprocessor instruments, or any other system requiring a self-contained readout. It is programmable to operate in a parallel or serial mode.

The parallel interface is a basic 8 bit parallel interface with handshaking and some dedicated control lines. The serial interface is RS-232C compatible with 8 selectable baud rates (from 150 - 19,200).

Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling or inserting lines and characters. The character generator is a 4K x 8 bit EPROM with 256 characters consisting of 128 ASCII characters (including control codes) and 128 block graphics characters. The character set can be factory or user modified.

Two means of using graphics are supported - character graphics, in which the user sends the proper ASCII code to select the desired graphics character, or the bit plot mode. The character graphics mode allows easy mixing of text and graphics images and the bit plot mode (using set and reset commands) allows any graphic pattern to be drawn a bit at a time.

A DC/DC converter generates the required display voltages from + 12 VDC and all input lines are LSTTL compatible with 4.7 kilohm pull-up resistors to Vcc.

MODEL APD-192G088

INTERFACING

PARALLEL INTERFACE

The parallel interface offers two forms of hand-shaking called Ready and Data Taken. Each 8 bit word appearing on the data bus is latched with the falling edge of the Data Strobe pulse.

This same negative transition notifies the on-board processor that data has been entered. The Ready signal then goes low and the Data Taken signal goes low momentarily. The Ready signal remains low until the command is completed or the data has been entered. The Data Taken pulse is normally 800 nanoseconds long and indicates when the on-board processor has read the input latch. Data may be entered into the input latch after the rising edge of Data Taken.

SERIAL RS-232C INTERFACE

(See J4 pin descriptions.) The controller is considered to be a DTE type device and will operate with a host that is either a DTE or DCE type device. The serial input and output lines meet RS-232C specifications. Serial data is entered asynchronously with selectable baud rates. The byte format is 1 start bit, 8 data bits and 1 stop bit.

CONTROL CODES	HEX	ASCII
Cursor Home	0E	CNTRL N
Carriage Return	0D	CNTRL M
Cursor Down (Line Feed)	OA	CNTRL J
Cursor Up	0B	CNTRL K
Cursor Right	09	CNTRL I
Cursor Left	08	CNTRL H
Alter Cursor Character Position Cursor Character Address (0-1F)	11	CNTRL Q
Alter Cursor Row Position Cursor Row Address (0-A)	13 ##	CNTRL S
Cursor On	12	CNTRL R
Cursor Off	14	CNTRL T
Clear Screen	0C	CNTRL L
Character Insert	OF	CNTRL O
Character Delete	10	CNTRL P
Line Insert	16	CNTRL V
Line Delete	17	CNTRL W
ESCAPE CONTROL CODES	E LATE	
Erase to End of Line	1B,0D	ESC CNTRL N
Erase to End of Screen	1B,18	ESC CNTRL X
Erase Line	1B,13	ESC CNTRL S
Erase Line and Carriage Return	1B,25	ESC SHIFT %
Alter Brightness 0 = Brightest 7 = Dimmest	1B,0C ##	ESC CNTRL L
Scroll	1B,1A	ESC CNTRL Z
* End Scroll	1B,20	ESC SPACE
Blank Display (on/off alternately)	1B,11	ESC CNTRL C
Enter Bit Plot Mode	1B,16	ESC CNTRL V
* Exit Bit Plot Mode	1B,17	ESC CNTRL V
Reset Controller (to initial state)	1B,19	ESC CNTRL Y

CONNECTOR	PIN	SIGNAL	DESCRIPTION
J1	1	+ 12 VDC	Panel supply voltage.
	2	+ 5 VDC	Logic supply voltage.
	3	GND	Ground.
	4	NC	No Connection.
J3	1,2,4,5,	DB7-DB0	Data bus lines used to transfer
	7,6,3,9		data and commands to display.
	13	READY	Used to monitor the display's activity. A logic 0 indicates that the display is busy and cannot respond to new data.
	15	DATA STROBE	Used to notify the display that valid data is present on the data bus. The data byte is loaded with the falling edge of DATA STROBE.
	17	DATA TAKEN	This output goes to logic 0 for approximately 800 nsec when the display has accepted the input data byte after DATA STROBE goes low. New data may be presented coincident with the leading edge of this signal.
	22	SYSTEM SELECT	Used as a unique unit select input. A logic 0 on this line disables the DATA STROBE input.
	10	CURSOR DISABLE	A logic 1 will disable the visual cursor. (This can also be accomplished with a data bus command.)
	16	INITIALIZE	Serves as a display reset. A logic 0 will initialize the controller to its power up state.
	12	RESERVED	This pin is to be left unconnected.
	25,26	+ 5 VDC	Logic supply voltage.
	19,20	GND	Ground.
J4	3 District to 200 District to 200	RECEIVE DATA	The display receives data on this pin. (The signal originates at the DCE device transmit pin 2.)
	2	TRANSMIT DATA	The display transmits received data on this pin. (The signal originates at the DCE device receive pin 3.)
	4	READY TO SEND	This pin will be low when the display is busy and cannot accept new data. (This pin is connected to pin 5 of the DCE device.)
	7	GND	Signal ground (required).
	(Pins 6, 8	3, and 20 of J4 are	e connected together internally.)
NOTE: Unidentif			

ORDERING INFORMATION

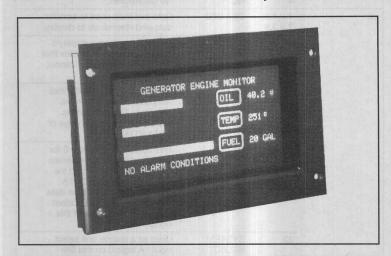
DESCRIPTION	PART NUMBER
Display, Drive Electronics, Controller Board (Includes DC/DC converter)	APD-192G088
Parallel Data Connector Kit	280105-01
Power Connector Kit	280108-04
Non-Glare Filter (amber circular polarized) - other filters available - contact factory	280109-06

DIN DESCRIPTION

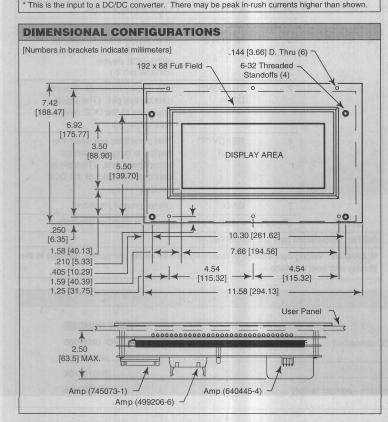
MODEL APD-192G088-5 Plasma Panel Display Modules

192 by 88 Graphics Display,
Drive Electronics Controller, and Infrared Touch Screen





STANDARD ELECTRICAL SPECIFICATIONS					
	MIN.	TYP.	MAX.	UNITS	
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V	
Logic Supply Current	gmosc <u>s.</u>	700		mA	
Panel Supply Voltage	+ 11.4	+12.0	12.6	V	
Panel Supply Current*		1.0	2.2	Α	
Logic One Voltage	2.0			V	
Logic Zero Voltage			0.8	V	
Logic Zero Input Current	indicat al		- 0.4	mA	



The APD-192G088-5 is a full field dot matrix display with 192 columns and 88 rows. It includes drive electronics, microprocessor based controller, IR touch panel and bezel. The controller maintains all the refresh memory, character generation, touch input and control logic to enable the module to serve as a direct input/output device for communications terminals, computer readouts, microprocessor instruments or any other system requiring a self-contained input/output terminal. It also controls the report of touch point coordinates from the touch panel to the host computer.

FEATURES

- 192 x 88 full field dot matrix
- Text or graphics modes
 (11 rows of 32 characters in text mode)
- Infrared touch panel
- 63 x 31 touch point format
- · Flexible operating modes
- All functions software accessible
- High brightness
- Wide viewing angle
- · Low input voltage
- · Parallel and serial interfaces

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: $0^{\circ}\text{C to} + 55^{\circ}\text{C}$. Storage Temperature: $-55^{\circ}\text{C to} + 85^{\circ}\text{C}$.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.66" [194.56] W x 3.50" [88.90] H.

Pixel Size: .020" [.508].

Pixel Pitch: .040" [1.02].

Luminance: 80 foot lamberts.

Color: Neon orange. Viewing Angle: 120° cone.

IR Beams: 32 on X axis, 16 on Y axis.

MODEL APD-192G088-5

GENERAL DESCRIPTION

The APD-192G088-5 consists of a graphics DC plasma display panel, IR touch screen, controller and bezel.

The controller maintains all the refresh memory, character generation, touch panel operation and control logic to enable the module to serve as a direct I/O device for communications terminals, computer readouts, microprocessor instruments or any other system requiring a self-contained terminal. It is programmable to operate in a parallel or RS-232C compatible serial mode with 7 selectable baud rates from 300 to 19,200.

Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling or inserting lines and characters. The character generator is a 4K x 8 bit EPROM with 256 characters consisting of 128 ASCII characters (including control codes) and 128 block graphics characters. The character set can be factory or user modified.

Two means of using graphics are supported - character graphics, in which the user sends the proper ASCII code to select the desired graphics character or the bit plot mode. The character graphics mode allows easy mixing of text and graphic images and the bit plot mode (using set and reset commands) allows any graphic pattern to be drawn a bit at a time.

The infrared touch screen consists of IR LEDs and detectors arranged to provide a grid of infrared light beams across the face of the display. If an object is present, then an intersecting pair of beams will be blocked and the controller will determine the coordinates of that point and report it to the host computer. Using simple input commands, the touch screen can be configured to report coordinates when a stylus is entered into the touch panel, when it is removed or continuously. Other commands are provided to allow control over the flow of touch point coordinates between the touch panel and the host computer.

A DC/DC converter generates the required display voltage from + 12 VDC and all input lines are LSTTL compatible with 4.7 kilohm pull-up resistors to Vcc.

INTERFACING

PARALLEL INTERFACE

The parallel interface offers two forms of handshaking called READY and DATA TAKEN. Each 8 bit word appearing on the data bus is latched with the falling edge of the DATA STROBE pulse.

This same negative transition notifies the on-board processor that data has been entered. The READY signal then goes low and the DATA TAKEN signal goes low momentarily. The READY signal remains low until the command is completed or the data has been entered. The DATA TAKEN pulse indicates when the on-board processor has read the input latch. Data may be entered into the input latch after the rising edge of DATA TAKEN.

SERIAL RS-232C INTERFACE

(See J4 pin descriptions.) The controller is considered to be a DTE type device and will operate with a host that is either a DTE or DCE device. The serial input and output lines meet RS-232C specifications. Serial data is entered asynchronously with selectable baud rates. The byte format is 1 start bit, 8 data bits and 1 stop bit.

COMMAND	CODE (HEX)		
Enable Exit Point Mode	20		
* Disable Exit Point Mode	21		
Enable Enter Point Mode	22		
* Disable Enter Point Mode	23		
Enable Continuous Mode	24		
* Disable Continuous Mode	25		
Enable Touch Screen	27		
Request Failed Beam Report	28		
Enable Report Transfer	29		
* Disable Report Transfer	2A		
Request Report	2B		
* Indicates default condition.			

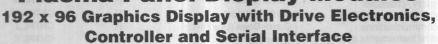
CONTROL CODES	HEX	ASCII
Cursor Home	0E	CNTRL N
Carriage Return	0D	CNTRL M
Cursor Down (Line Feed)	OA	CNTRL J
Cursor Up	0B	CNTRL K
Cursor Right	09	CNTRLI
Cursor Left	08	CNTRL H
Alter Cursor Character Position Cursor Character Address (0-1F)	11 ##	CNTRL Q
Alter Cursor Row Position Cursor Row Address (0-A)	13 ##	CNTRL S
Cursor On	12	CNTRL R
Cursor Off	14	CNTRLT
Clear Screen	OC	CNTRL L
Character Insert	0F	CNTRL O
Character Delete	10	CNTRL P
Line Insert	16	CNTRL V
Line Delete	17	CNTRL W
ESCAPE CONTROL CODES		
Erase to End of Line	1B,0D	ESC CNTRL M
Erase to End of Screen	1B,18	ESC CNTRL X
Erase Line	1B,13	ESC CNTRL S
Erase Line and Carriage Return	1B,25	ESC CNTRL %
Alter Brightness 0 = Brightest 7 = Dimmest	1B,0C ##	ESC CNTRL L
Scroll	1B,1A	ESC CNTRL Z
* End Scroll	1B,20	ESC SPACE
Blank Display (on/off alternately)	1B,11	ESC CNTRL Q
Enter Bit Plot Mode	1B,16	ESC CNTRL V
* Exit Bit Plot Controller	1B,17	ESC CNTRL W
Reset Controller (to initial state)	1B,19	ESC CNTRL Y

CONNECTOR	PIN	SIGNAL
J1	1	+ 12 VDC
	2	+ 5 VDC
	3	GND
	4	NC
J3	1, 2, 4, 5, 7, 6, 3, 9	DB7-DB0
	13	READY
	15	DATA STROBE
	17	DATA TAKEN
	22	SYSTEM SELECT
	10	CURSOR DISABLE
	16	INITIALIZE
	12	RESERVED
	25, 26	+ 5 VDC
	19, 20	GND
J4	3	RECEIVE DATA
	2	TRANSMIT DATA
	4	READY TO SEND
	5	CLEAR TO SEND
	7	GND
(Pins 6, 8 and 20 of	J4 are connected together into	ernally.)

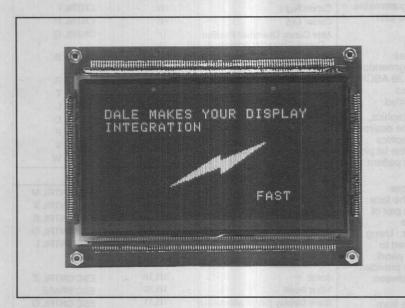
ORDERING INFORMATION	
DESCRIPTION	PART NUMBER
Display, Drive Electronics, plus Controller, Touc	ch Screen
and Bezel (Includes DC/DC Converter)	APD-192G088-5
Parallel Data Connector Kit	280105-01
Power Connector Kit	280108-04

permanent damage to the display.

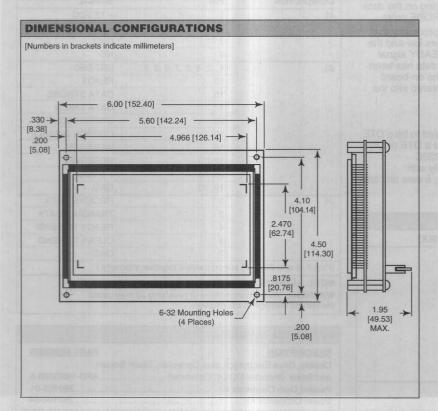
MODEL APD-192G096 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS				
- Anuma ass	MIN.	TYP.	MAX.	UNITS
Supply Voltage	4.75	5.0	5.25	V
Supply Current		1.0	2.5	А



The APD-192G096 is a full field dot matrix display with 192 columns and 96 rows. It includes drive electronics and a microprocessor based controller consisting of refresh memory, character generator and control logic. Interface is via RS-232 that allows for efficient handshaking and data protocol for bi-directional data interface with selectable baud rates from 150 to 19,200. A DC/DC converter is also included to develop the necessary panel voltage. Applications include POS terminals, industrial controls, computer peripherals, measurement instruments and office machines.

FEATURES

- 192 x 96 full field dot matrix
- · Text or graphics modes (8 rows of 32 characters in text mode)
- Only + 5 VDC required
- Very compact size
- Wide Viewing angle (150°)
- Flicker free refresh
- Editing functions
- High brightness

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C. Relative Humidity: 10-90% R.H. non-

condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018 [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 4.966" [126.14] W

x 2.470" [62.74] H.

Pixel Size: 0.017 [0.43] square. Pixel Pitch: 0.026 [0.66]. Luminance: 70 foot lamberts.

MODEL APD-192G096

GENERAL DESCRIPTION

The APD-192G096 consists of a graphics DC plasma display panel, controller and DC/DC converter.

The controller maintains all the refresh memory, character generation and control logic to enable the module to serve as a direct readout device for many applications including POS terminals, industrial controls and microprocessor instruments. Single byte, two and three byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling or inserting lines and characters. An EPROM based character generator is easily configured for any character set, but comes standard with three variations of international fonts (Standard International, International plus Kata-kana and International plus Russian) and 128 block graphics characters. Alternate character sets can be factory or user programmed. The pixel pattern in text mode is 5 x 7 pixels in an 6 x 12 block. Two means of using graphics are supported. The first is character graphics, in which the user sends the proper ASCII code to select the desired graphics character. The character graphics mode allows easy mixing of text and graphics images. The second is the bit plot mode (using set and reset commands) which allows any graphic pattern to be drawn a bit at a time. Character entry in bit mode allows for 5 x 7 ASCII characters to be placed at any given pixel location within the pixel map.

A FIFO buffer is used to capture incoming data in the event the display's microprocessor is busy with a length command. Handshaking is suggested when operating in the graphics mode. The data format is 1 start bit, 8 data bits and 1 stop bit.

OPERATING MODE DESCRIPTION

DC1 - (Overwrite Mode) The cursor advances automatically when character data is written. If it is at the last column in a row, it shifts to the first column of the next row.

DC2 - (Vertical Scroll Mode) The cursor advances automatically when character data is written. If it is at the last column of the last row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the first column of the last row.

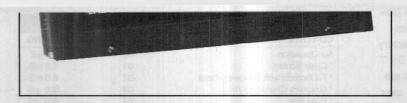
PIN DESCRIPTIO	N	
PIN	SIGNAL	
1, 2	+ 5 VDC	
7	BELL	
3, 4	GROUND	
8	N/C	
5, 6	+ 5 VDC	
11	TXD	
12	CTS	
13, 14	N/C	
15, 16	GROUND	
9	RXD	
10	RTS	

COMMAND SUMMARY		
CONTROL COMMANDS	CODE (HEX)	TIMING
No Operation	00	40 μS
* Clear Screen	01	6.0 mS
* Fill Screen with Following Data	02	6.0 mS
* Graphics Character Write	03	600 μS
* Pixel Set	04	280 μS
* Pixel Reset	05	280 μS
No Operation	06	40 μS
No Operation	07	40 μS
Cursor Left	08	210 μS
Cursor Right	09	210 μS
Cursor Down	OA	210 μS
Cursor Up	0B	210 μS
Clear Screen, Home Cursor	OC	6.4 mS
Carriage Return	0D	210 μS
Home Cursor	0E	210 μS
Insert Character	0F	1.2 mS
Delete Character	10	1.2 mS
Re-position Cursor Column	11	190 μS
Cursor Select, Data Byte	12	190 μS
Re-position Cursor Row	13	190 μS
Character Generator Select	14	190 μS
Erase Line/Carriage Return	15	650 μS
Insert Line	16	2.2 mS
Delete Line	17	2.2 mS
Select Text Mode	18	110 μS
Select Graphics Mode	19	110 μS
No Operation	1A	40 μS
No Operation	1B	40 μS
Set to DC1 (Overwrite) Mode	1C	90 μS
Set to DC2 (Vertical Scroll) Mode	1D	90 μS
Blank Display (Data Saved)	1E	120 μS
Unblank Display (Restores Screen)	1F	120 μS

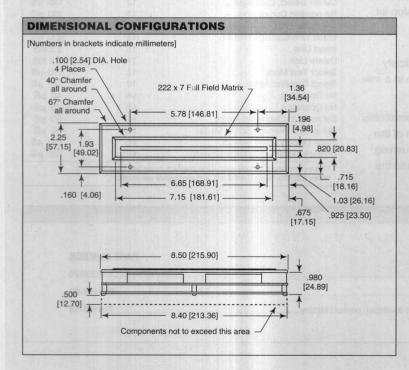
^{*} These commands are only valid if the graphics mode has been selected. When graphics mode is selected, text commands are invalid.

ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Display, Drive Electronics and Controller	APD-192G096
Mating Connector	280105-02
Non-Glare Filter (amber circular polarized) - other filters available, contact f	actory



STANDARD ELECTRICAL SPECIFICATIONS				
da us Su org	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V
Logic Supply Current			230	mA
Panel Supply Voltage	237.5	250.0	262.5	V
Panel Supply Current			35	mA
Logic One Voltage	2.0	_	10 mu emal	V
Logic Zero Voltage			0.8	V
Logic Zero Input Current		10 m = 10	- 17.2	mA



The superior esthetics of a plasma display combined with a package that conserves front panel area enables this module to serve as an output device for many applications including automatic teller machines, point of sale systems and microprocessor instruments.

FEATURES

- 32 or 37 alphanumeric characters
 (5 x 7 dot matrix) or 222 x 7 graphics format
- · Bezel and filter included
- Wide viewing angle (150°)
- Compact size
- Replacement for Burroughs SSD0132-0039

OPTICAL SPECIFICATIONS

Viewing Area: 6.65" [168.91] W x .196" [4.98] H.

Pixel Size: .019" [.483] W x .016" [.406] H.

Pixel Pitch: .030" [.762].

Luminance: 60 foot lamberts.

Color: Neon orange.

Viewing Angle: 150° cone.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side

of the 3 major axes.

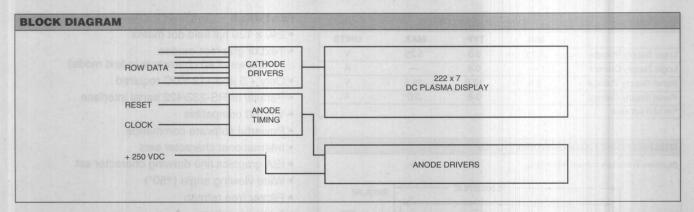
MODEL APD-222G007

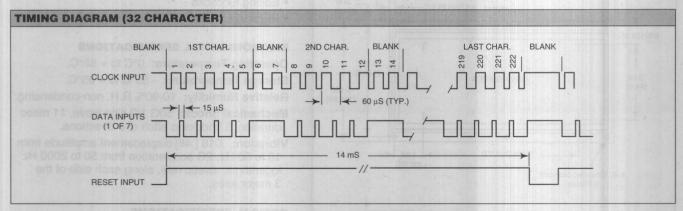
GENERAL DESCRIPTION

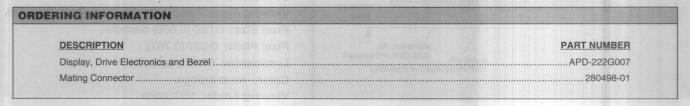
The APD-222G007 consists of a DC plasma display panel, drive electronics and bezel and is designed for a direct replacement of Burroughs type SSD0132-0039 display modules.

The display tube has 222 columns and 7 rows, which allows display of any dot matrix information presentable in 222 columns by 7 rows of dots. The display operates by scanning one column at a time (for each clock pulse input). At the end of the 222nd clock period, a reset pulse must be applied to reset the display and start a new scan at column 1. The scanning is done at 70-80 Hz so the display characters do not flicker. Dot matrix information is presented to the 7 data input lines column by column. To display information in any specified column, clock pulses must be counted starting with the first clock pulse after reset. Each clock pulse equals one column "on" time; thus, the number of clock pulses equals the column which is being scanned. A logical 0 at any data input lights a pixel. The data inputs must be held in the logic 1 state for 15 microseconds after each negative clock transition and during the entire reset period. Input data must be present for the entire "on" time of the displayed column.

PIN DESCRIPTION					
PIN	SIGNAL				
1	N/C				
2	N/C				
3	N/C				
4	ROW 1 DATA				
5	ROW 3 DATA				
6	ROW 5 DATA				
7	ROW 6 DATA				
8	N/C				
10	N/C				
11	N/C				
12	+ 250 VDC				
A	N/C	3.4			
В	N/C				
C	N/C				
D	N/C				
E	ROW 2 DATA				
F	ROW 4 DATA				
H	ROW 7 DATA				
J	N/C				
K	CLOCK				
L	+ 5 VDC				
M	RESET				
N	GROUND				
Polarizing key between pir	ns 7 and 8.				



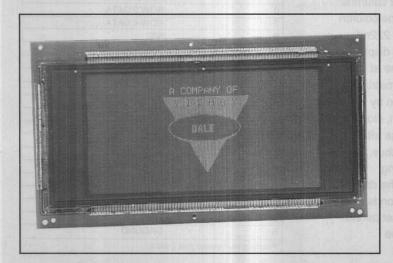




MODEL APD-240G120 Plasma Panel Display Modules







with 240 columns and 120 rows. It includes drive
electronics, and a microprocessor based ASCII and
VT-100 compatible controller consisting of refresh
memory, character generator and control logic with
parallel or serial interface and a DC to DC converter
to generate the necessary panel voltage.
When used in the text mode the module will display
12 lines by 40 characters. Applications include
POS terminals, industrial controls, computer
peripherals, measurement instruments and office
machines.
A touch panel version is also available

The APD-240G120 is a full field dot matrix display

A touch panel version is also available (APD-240G120-5).

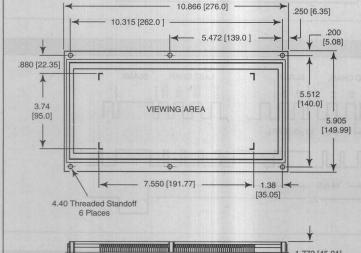
STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	4.75	5.0	5.25	V
Logic Supply Current	White-Ridge	0.4		Α
Panel Supply Voltage	9.5	12.0	28.5	V
Panel Supply Current *		0.8	3.0	A
* At 10 O walt input		THE SECOND SECTION		

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

FEATURES

- 240 x 120 full field dot matrix
- Text or graphics modes (12 rows of 40 characters in text mode)
- Only + 5 and +12 VDC required
- Parallel or RS-232/422 serial interface
- VT-100 compatible
- Powerful software commands
- International character sets
- ISA graphics line drawing character set
- Wide viewing angle (150°)
- · Flicker free refresh
- Editing functions
- High brightness



ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to $+55^{\circ}\text{C}$. Storage Temperature: -55°C to $+85^{\circ}\text{C}$.

Relative Humidity: 10-90% R.H. non-condensing. Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018 [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.550" [191.77] W x 3.740" [95.00] H.

Pixel Size: 0.020 [0.508] diameter. Pixel Pitch: 0.031 [0.787]. Luminance: 60 foot lamberts.

MODEL APD-240G120

GENERAL DESCRIPTION

The APD-240G120 consists of a graphics DC plasma display panel, controller and DC/DC converter. Dale's® patented open construction display technology assures a stable flicker free screen.

Interface is through either a parallel or RS-232/422 serial interface. The parallel interface allows for efficient handshaking and data protocol for bi-directional data interface. The serial interface is very flexible allowing for many selectable baud rates (150 to 19,200) and data formats. A second serial port allows for communication with the optional IR touch panel and software is available that allows for simple integration.

An EPROM based character generator is easily configured for any character set, but comes standard with three variations of international fonts (Standard International, International plus Kata-kana and International plus Russian) and the standard ISA 96 character graphics line drawing character set. Alternate character sets can be factory or user programmed. The pixel pattern in text mode is 5 x 7 pixels in a 6 x 10 block. The characters are adjusted for one pixel space above, one space to the right and 2 spaces on the bottom of each character.

Various editing functions are available such as scrolling, inserting and deleting characters.

A FIFO buffer is used to capture incoming serial data in the event the display's microprocessor is busy with a lengthy command. Handshaking is suggested when operating in the graphics mode. The data format is programmable.

The touch panel version (APD-240G120-5) includes a Dale® TIP-3216 infrared touch panel that consists of IR LEDs and detectors arranged to provide a grid of infrared light beams across the face of the display. When a pair of intersecting beams are blocked by a finger or stylus, the module will report the coordinates to the host computer. Various reporting modes are supported such as ENTER, EXIT, TRACKING and CONTINUOUS. All of the touch panel functions are controlled through the display controller so the user doesn't have to provide an additional serial port. The touch panel includes an attractive sealed bezel and contrast enhancement filter, providing an elegant solution for menu driven applications.

OPERATING MODE DESCRIPTION

DC1 - (Overwrite Mode) The cursor advances automatically when character data is written. If it is at the last column in a row, it shifts to the first column of the next row.

DC2 - (Vertical Scroll Mode) The cursor advances automatically when character data is written. If it is at the last column of the last row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the first column of the last row.

DC3 - Cursor is turned on.

DC4 - Cursor is turned off.

DC5 - Cursor is turned on and blinks at 4 Hz.

PIN DESCRIP	TION	THE LANGE THE PARTY OF THE PART		
CONNECTOR	PIN	SIGNAL		
J1	1	+ 12 VDC		
	2	GROUND		
	3	N/C		
	4	+ 5 VDC		
J2	1	GROUND		
	2	TXD		
	3	RXD		
	4	RTS		
	5	CTS		
	6	N/C		
	7	GROUND		
	8, 9	N/C		
J3	1, 3, 5, 7, 9, 11, 13, 15	DB0-DB7		
	17	WR (Write)		
	19	US (Unit Select)		
	21	RD (Read)		
	23	CLR (Clear Display)		
	25	BL (Blank Display)		
	6	A0 (Register Select		
	12	CHK (Self Test)		
	24	BUSY OUTPUT		
	2, 4, 8, 10, 14, 16, 18, 20, 22, 26	GROUND		

WARNING: Wrong connections may cause permanent damage to the display and host system.

Cursor Left (Back Space) Erase to End of Line Cursor Right (Horizontal Tab) Erase to End of Screen Cursor Down (Line Feed) Scroll Cursor Up (Vertical Tab) Alter Cursor Column Clear Screen Alter Cursor Row

ABRIDGED TEXT FUNCTION SUMMARY

Clear Screen
Clear Screen, Home Cursor
Carriage Return
Cursor Home
Cursor On
Cursor Off
Cursor Off
Cursor Off
Cursor Character

Alter Cursor Row
Insert Line
Delete Line
Set Operating Mode
Read Cursor Position
Read Data at Cursor
Reset

Delete Character

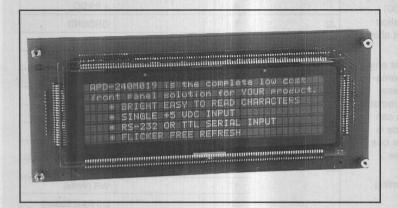
ORDERING INFORMATION

<u>DESCRIPTION</u>	PART NUMBER
Display, Drive Electronics and Controller	APD-240G120
Parallel Connector Kit	280105-01
Power Connector Kit	280108-05
Non-Glare Filter (amber circular polarized) - other filters available, contact factory	280109-11

MODEL APD-240M019 Plasma Panel Display Modules







240 alphanumeric 5 x 7 dot matrix characters arranged in 6 lines of 40 characters each.
The module includes drive electronics, a controller
consisting of refresh memory, character generator
and control logic with an RS-232 compatible ASCII
input. Interface is through a single 4 pin power
connector. Handshaking is not required as
a 20 byte FIFO buffer is used to capture data when
the display is busy. Applications include POS
terminals, industrial controls, computer peripherals,
measurement instruments and office machines.

The APD-240M019 display module displays up to

STANDARD ELECT	RICAL SPI	ECIFICATI	ONS	
	MIN.	TYP.	MAX.	UNITS
Panel Supply Voltage	4.75	5.0	5.25	V
Panel Supply Current	1.0	1.5	2.5	Α

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]

FEATURES

- 240 (6 x 40) alphanumeric characters (5 x 7 dot matrix)
- Compatible with Noritake CU40066MCPB-S31A
- Only + 5 VDC required
- Three international character sets (other character sets available)
- Efficient serial interface (TTL or RS-232)
- Four step brightness control
- Wide viewing angle (150°)
- Rugged design/slim profile
- Flicker free refresh
- Editing functions
- High brightness

.200 ± .010 [5.08 ± .254]			
-	10.63 [270.0]	<u>→</u>	
→	10.23 [259.84]	→ led spend	
	Alber Contact Color Alber Contact Color Alber Contact Color Alber Contact Color Alber Color	1.83 [96.0 [46.48]	
.140	7.43 [188.72]	.976	275 [6.99]
Thru [35.56] 4 Places			
		.530 [13.46]	

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: $0^{\circ}\text{C to} + 55^{\circ}\text{C}$. Storage Temperature: $-55^{\circ}\text{C to} + 85^{\circ}\text{C}$.

Relative Humidity: 10-90% R. H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of

6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

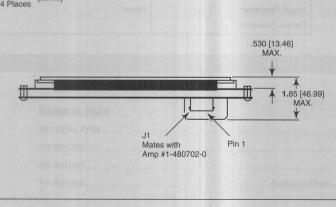
OPTICAL SPECIFICATIONS

Viewing Area: 7.43" [188.72] W x 1.83" [46.48] H.

Number of Characters: 240.

Character Size: .137" [3.48] W x .196" [4.98] H.

Luminance: 100 foot lamberts.



MODEL APD-240M019

GENERAL DESCRIPTION

The APD-240M019 plasma display module consists of a multiplexed DC plasma display, drive circuitry and switching voltage converter mated with an intelligent, microprocessor-based controller board. The resulting assembly interfaces easily to microprocessor-based systems and only requires readily available low voltages for power. Dale's patented open construction display technology assures a stable flicker free screen. Interfacing is very simple (and requires no handshaking as a 20 byte FIFO buffer captures data when the display is busy) through a single 4 pin connector that has + 5 VDC, RESET, GROUND and SERIAL DATA connections. The serial data interface can be either RS-232 or TTL level, selectable on the controller.

An EPROM based character generator is easily configured for any character set, but comes standard with three variations of international fonts (Standard International, International plus Kata-kana and International plus Russian) which are software selectable.

Serial data protocol is 8 data bits, no parity, 1 start bit and 1 stop bit. Baud rate (300, 1200, 9600 or 19,200) is selected with a control board jumper.

Various editing functions are available such as scrolling, inserting and deleting characters. The display can also be dimmed or blanked for screen highlighting.

OPERATING MODE DESCRIPTION

DC1 - (Overwrite Mode) The cursor advances automatically when character data is written. If it is at the last column in a row, it shifts to the first column of the next row.

DC2 - (Vertical Scroll Mode) The cursor advances automatically when character data is written. If it is at the last column of the last row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the first column of the last row.

DC3 - The cursor is visible as a non-blinking underbar.

DC4 - The cursor is invisible.

ORDERING INFORMATION

DC5 - The cursor is visible as a blinking character block.

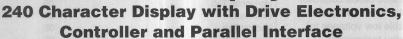
DC6 - The cursor is visible as a blinking underbar.

COMMAND SUMMARY			
CONTROL COMMANDS	CODE (HEX)	TIMING	
Back Space	08	190 μS	
Horizontal Tab	09	190 μS	
Line Feed	0A	190 μS	
Vertical Tab	0B	190 μS	
Cursor Home*	0C	130 μS	
Carriage Return	0D	210 μS	
Clear Screen (cursor remains)*	0E	3.0 mS	
Select DC1, Overwrite Mode*	11	130 μS	
Select DC2, Vertical Scroll Mode	12	130 μS	
Select DC3, Cursor On, Underline*	13	130 μS	
Select DC4, Cursor Off	14	130 μS	
Select DC5, Cursor On, Blinking Block	15	130 μS	
Select DC6, Cursor On, Blinking Underbar	16	130 μS	
Character Set 0 (International)*	17	110 µS	
Character Set 1 (Intl. + Kata-kana)	18	110 µS	
Character Set 2 (Intl. + Russian)	19	110 μS	
ESCAPE COMMANDS			
Position Cursor	1B, 48	150 μS	
Cursor Address	##		
Luminance Control	1B, 4C, ##	310 μS	
Initialize (Software Reset)	1B, 49	500 mS	
Character Blink Start	1B, 42	130 μS	
Character Blink Stop	1B, 41	130 μS	
EXTENDED CONTROL COMMANDS			
Position Cursor	1B, 58	150 μS	
Cursor Address	##		
Insert Character	1B, 58, F3	500 μS	
Delete Character	1B, 58, F4	500 μS	
Line Insert	1B, 58, F5	2.0 mS	
Line Delete	1B, 58, F6	2.0 mS	
Reset (to power up status)	1B, 58, FF	500 μS	
* Power up default condition.		vict single	

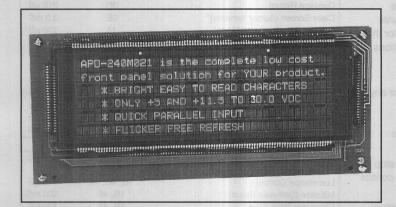
PIN DESCRIPTION			
PIN	SIGNAL		
1	+ 5 VDC		
2	SERIAL DATA		
3	GROUND		
4	RESET (hardware)		

DESCRIPTION	PART
Display, Drive Electronics, Controller	APD-
Mating Controller	28

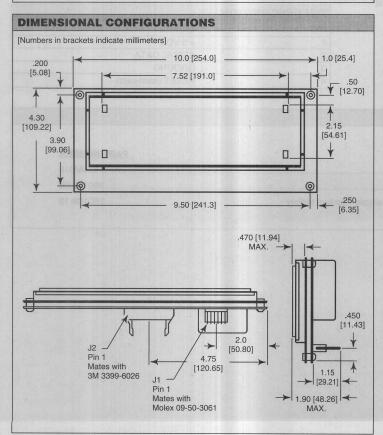
MODEL APD-240M021 Plasma Panel Display Modules







	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	٧
Logic Supply Current		300.0	ort Characters	mA
Panel Supply Voltage	11.5	12.0	30.0	od V
Panel Supply Current*		600.0	1000.0	mA
Logic One Voltage	2.4			V
Logic Zero Voltage			.8	V
Logic Zero Input Current	_101		4	mA
* At 12 volt input.				



The APD-240M021 display module displays up to 240 alphanumeric 5 x 7 dot matrix characters arranged in 6 lines of 40 characters each. The module includes drive electronics, a controller consisting of refresh memory, character generator and control logic with ASCII input. Interfacing is very simple (over an 8 bit data bus) and requires minimum handshake to enable the module to serve as a cost effective direct readout device for many applications including POS terminals, industrial controls, computer peripherals, measurement instruments and office machines.

FEATURES

- 240 (6 x 40) alphanumeric characters (5 x 7 dot matrix)
- Compatible with IEE 3402-08-240N
- Only + 5 and + 11.5 to 30.0 VDC required
- ASCII character set (optional character sets available)
- · Efficient parallel interface
- Wide viewing angle (150°)
- · Rugged design/slim profile
- · Flicker free refresh
- Editing functions
- High brightness

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. **Storage Temperature:** - 55°C to + 85°C.

Relative Humidity: 10-90% R. H. non-condensing. **Mechanical Shock:** 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.52" [191.01] W x 2.15" [54.61] H.

Number of Characters: 240.

Character Size: 0.15" [3.81] W x .0.21" [5.33] H.

Luminance: 100 foot lamberts.

MODEL APD-240M021

GENERAL DESCRIPTION

The APD-240M021 plasma display module consists of a multiplexed DC plasma display, drive circuitry and switching voltage converter mated with an intelligent, microprocessor-based controller board. The resulting assembly interfaces easily to microprocessor-based systems and requires only readily available low voltages for power. Dale's® patented open construction display technology assures a stable flicker free screen.

Interfacing is a basic 8 bit parallel ASCII interface with some dedicated control lines and requires minimum handshaking. DEVICE SELECT (CS), ADDRESS (Ao), WRITE and READ lines are enabled in accordance with the Function Summary Chart and allow the host system to write or read data from the display. Data bus signals are formatted in accordance with the standard ASCII which allow control functions to be included in the character code matrix table. Functions such as advancing the cursor position or selecting the end-ofline mode are implemented with a single 8 bit control

Characters sent on the data bus are entered at the cursor position addressed and latched by the display module when it receives a WRITE pulse. The cursor then automatically advances to the next character position. Characters may be randomly entered at any position on the display field by first sending the module a command to set the cursor at the desired character location and then entering a character as described. When the last display line is filled, the end-of-line mode selected determines the location of the "overflow"

A self test can be activated by maintaining a logic low at J2-1 (T₀) for a period longer than 4 seconds. RESET can be accomplished with a data bus command or bringing the RESET input low for 20 msec minimum. The display may be blanked (without loosing display contents) by applying a logic 0 to J1-2 (SHUTDOWN).

When a byte of data is placed on the bus and a WRITE pulse is applied to WR, the data is entered into an input buffer in the microprocessor. The data is examined to determine its nature (control code, ASCII character, etc.) and if it is a character, it is stored in the display refresh memory. The time required to execute this process and prepare for a new character determines the display's character loading rate. Most commands and character entry are executed within 80 µsec.

Maximum loading rate is obtained by first writing the character to the display and then reading the input buffer status to determine when the next character can be sent. Data should be written to the display only when the input buffer is empty, indicating that it is ready to accept another byte of data.

PIN DESCRIPTION			
CONNECTOR	PIN	SIGNAL	
J1		+ 5 VDC	
Drive El	2	SHUT DOWN	
	3	+ 11.5 to + 30.0 VDC	
	4	GND (Logic)	
	5	GNO (Power)	
	6	RESET	
J2	1	T ₀	
	3	CS	
	5	READ	
	7	A ₀	
	9	WRITE	
	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26	GND	
	11, 13, 15, 17, 19, 21, 23, 25	DB0-DB7	

WARNING: Wrong connections or reversing J2 may cause permanent damage to the display and host.

FUNCTION	BUS CODE	Ao	CS	WR	RD
Write ASCII Data to Display	ASCII DATA	0	0	pl	1
Prepare to Read Data at Present Cursor Location	04	0	0	pl	1
Backspace	08	0	0	pl	1
Horizontal Tab	09	0	0	pl	1
Line Feed	0A	0	0	pl	1
Vertical Tab	0B	0	0	pl	1
Clear Screen	0C	0	0	pl	1
Carriage Return	0D	0	0	pl	1
Cursor Home	0E	0	0	pl	1
Character Insert	0F	0	0	pl	1
Character Delete	10	0	0	pl	1
Alter Cursor Column Position					
(2 byte command)	11	0	0	pl	1
Cursor Column Address	##	0	0	pl	1
Cursor on	12	0	0	pl	1
Alter Cursor Row Position (2 byte command	13	0	0	pl	1
Cursor Row Address	##	0	0	pl	1
Cursor Off	14	0	0	pl	1
Line Insert	16	0	0	pl	1
Line Delete	17	0	0	pl	1
Start Underbar/Blinking Character Field	18	0	0	pl	1
End Underbar/Blinking Character Field	19	0	0	pl	1
Prepare to Read Data at Present Cursor					
Location and Increment Cursor	43	1	0	pl	1
Prepare to Read Cursor Column Position	54	1	0	pl	1
Prepare to Read Cursor Row Position	55	1	0	pl	1
Read Data From Data Bus		0	0	1	pl
Read Input/Output Buffer Status		1	0	1	pl
Disable Display Data Input	x	1	1	X	X

NOTES: Data bus code shown in hexadecimal pl = Pulse Low

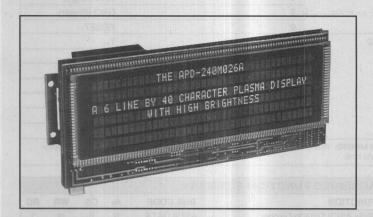
ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Display, Drive Electronics, Controller	APD-240M021
Parallel Data Connector Kit	280105-01
Power Connector Kit	280108-07
Non-Glare Filter (amber circular polarized) - other filters available - contact factory	280109-13

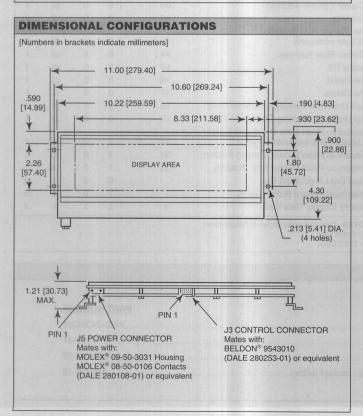
MODEL APD-240M026A Plasma Panel Display Modules

240 Character Display with Drive Electronics





STANDARD ELECTRICAL SPECIFICATIONS						
`r 10 0 0	MIN.	TYP.	MAX.	UNITS		
Logic Supply 1 Voltage	4.75	5.0	5.25	V		
Logic Supply 2 Voltage	11.40	12.0	12.60	V		
Logic Supply 1 Current		50.0	60.0	mA		
Logic Supply 2 Current		60.0	75.0	mA		
Panel Supply 1 Voltage	60.0	65.0	70.0	٧		
Panel Supply 2 Voltage	- 110.0	- 115.0	- 120.0	V		
Panel Supply 1 Current	-	60.0	128.0	mA		
Panel Supply 2 Current	-11	80.0	135.0	mA		



The APD-240M026A display module displays up to 240 alphanumeric 5 x 7 dot matrix characters arranged in 6 lines of 40 characters each. The module includes drive electronics and is easily interfaced to CRT controllers.

FEATURES

- 240 (6 x 40) alphanumeric characters (5 x 7 dot matrix)
- .14 W x .26 H character size
- High brightness (100 foot lamberts typical)
- Controller Board available with parallel and RS232 inputs
- Wide viewing angle (150°)
- Easily interfaced
- Compact size

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 Sine Wave,

11 ms duration, 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 minute duration

along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 2.26" [57.40] W x 8.33" [211.58] L.

Number of Characters: 240.

Character Size: .14" [3.56] W x .26" [6.60] H.

Dot Size: .020" [.508] diameter. **Dot Pitch, Vertical:** .040" [1.016]. **Dot Pitch, Horizontal:** .030" [.762].

Character Spacing: 2 blank columns of dots

between successive characters. **Brightness:** 100 foot lamberts.

Color: Neon orange. Viewing Angle: 150° cone.

GENERAL DESCRIPTION

The APD-240M026A consists of a DC plasma panel display and drive circuitry to accept serially entered row data and generate the required cathode and anode signals to display the desired information. The module displays information in a row scanning mode; that is, row by row beginning at the top, with each character being 5 dots wide, and with 40 characters per row, 200 bits of dot information per row is supplied to the module as serial data. When all 200 bits of row information have been loaded, the data will be displayed. This process is repeated until all 42 rows have been scanned in succession. All inputs are TTL compatible.

MODEL APD-240M026A

INTERFACE SIGNAL DESCRIPTION

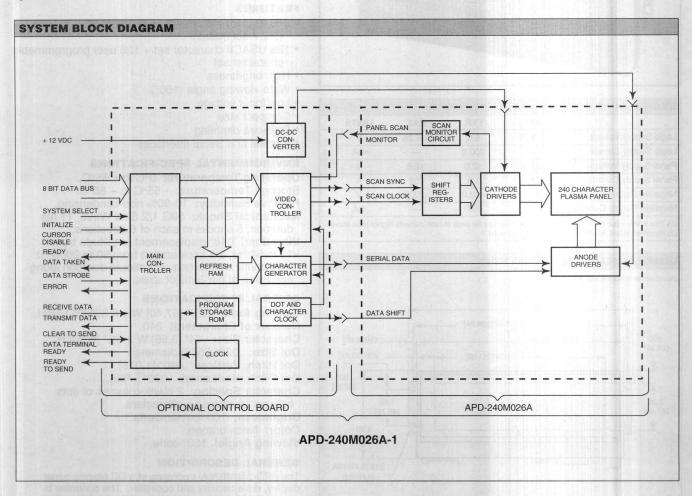
Serial Data - The 200 bits of data that represent one row of character data is serially entered on this input. The information is entered at the 200th dot position (right side of display) and is advanced one column with each Data Shift pulse.

Data Shift - A negative going edge on this input enters the row data bit present at the Serial Data input. This input requires 200 pulses to enter the 200 bits of row data.

Scan Clock - Much like horizontal sync on a CRT, this signal is used to advanced the the row pointer vertically down the display, one row at at time. This input must be continually pulsed whenever the display is on to prevent damage to the panel.

Scan Sync - This pulse is applied after each complete scan to begin a new scan at the top row of the panel, similar to vertical sync on a CRT.

PIN DESCRIPTION				
CONNECTOR	PIN	SIGNAL		
J3	1	DATA SHIFT		
	2	GROUND		
	3	N/C		
	4	+ 12 VDC		
	5	SCAN SYNC		
	6	SCAN CLOCK		
	7	+ 5 VDC		
	8	SCAN MONITOR		
	9	GROUND		
	10	SERIAL DATA		
J5	Α	- 115 VDC		
	В	GROUND		
	С	+ 65 VDC		

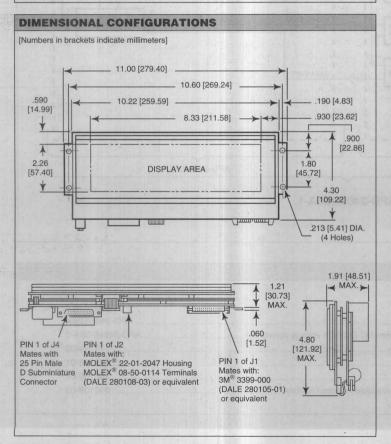


DERING INFORMATION	表。中国建设的国际企业
de en la comitación de comparación de la comparación del comparación de la comparación del comparación de la comparación de la comparación	
DESCRIPTION	PART NO.
Display and Drive Electronics	APD-240M026A
Display and Drive Electronics plus Controller Board (includes DC-DC high voltage converter)	APD-240M026A-1
DC-DC High Voltage Converter	PDS-400
Data Connector Kit	280253-01
Power Connector Kit	280108-01
Non-Glare Filter (amber circularly polarized) - other filters available - contact factory	280109-03



	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	5.0	+ 5.25	V
Logic Supply Current	-	700.0		mA
Panel Supply Voltage	11.4	12.0	12.6	٧
Panel Supply Current (1)		1.0	2.2	Α
Negative Supply Voltage (2)	11.4	- 12.0	- 12.6	V
Negative Supply Current		60.0		mA

(1) This is the input to a DC-DC converter. There may be peak in rush currents higher than shown. (2) Required only if RS-232-C serial interface is used.



- 240 (6 x 40) alphanumeric characters (5 x 7 dot matrix)
- 128 USACII character set + 128 user programmable character set
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- · Software dimming
- · Parallel and Serial Interfaces

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 Sine Wave, 11 ms duration, 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 minute duration along

each side of the 3 major axes. OPTICAL SPECIFICATIONS

Viewing Area: 2.26" [57.40] W x 8.33" [211.58] L.

Number of Characters: 240.

Character Size: .14" [3.56] W x .26" [6.60] H.

Dot Size: .020" [.508] diameter.
Dot Pitch, Vertical: .040" [1.016].
Dot Pitch, Horizontal: .030" [.762].

Character Spacing: 2 blank columns of dots

between successive characters. **Brightness:** 100 foot lamberts.

Color: Neon orange. Viewing Angle: 150° cone.

GENERAL DESCRIPTION

The APD-240M026A-1 consists of a DC plasma panel display, drive circuitry and controller. The controller is programmable to operate in a parallel or serial mode. The parallel interface is a basic 8 bit parallel interface with handshaking and some dedicated control lines. The serial interface is RS-232-C compatible with 8 selectable baud rates and 2 bit formats. Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling, or inserting lines and characters.

The character generator is a 4K x 8 bit EPROM and is capable of storing two 128 character sets. The standard set consists of 128 USASCII characters (including control codes). An alternate set of 128 characters can be user programmed.

A DC-DC converter generates the required display voltage from + 12 VDC, and all input lines are LSTTL compatible with 6.8 kilohm pull-up resistors to Vcc.

	10,20	ESU, SHIFT-&
NTRL-L CHARACTER BLINK	1B, 21	ESC, SHIFT-!
NTRL-O * DISABLE CHARACTER BLINK	1B, 22	ESC, SHIFT-"
NTRL-P START CONFIDENCE TEST	1B, 1F	ESC, SHIFT
NTRL-V * DISABLE CONFIDENCE TEST (ANY CODE)	##	
NTRL-W RESET CONTROLLER (TO INITIAL STATE)	1B, 19	ESC, CNTRL-Y
1	NTRL-O * DISABLE CHARACTER BLINK NTRL-P START CONFIDENCE TEST NTRL-V * DISABLE CONFIDENCE TEST (ANY CODE)	NTRL-O * DISABLE CHARACTER BLINK 1B, 22 . NTRL-P START CONFIDENCE TEST 1B, 1F NTRL-V * DISABLE CONFIDENCE TEST (ANY CODE) ##

PIN DESCRI	PTIO	N AND THE RESERVE TO
CONNECTOR	PIN	SIGNAL
J1	9	DATA BIT 1 (LSB)
	3	DATA BIT 2
	6	DATA BIT 3
	7	DATA BIT 4
	5	DATA BIT 5
	4	DATA BIT 6
	2	DATA BIT 7
	1	DATA BIT 8 (MSB)
	10	CURSOR DISABLE
	12	ERROR
	13	READY
	15	DATA STROBE
	16	INITIALIZE
	17	DATA TAKEN
	22	SYSTEM SELECT
	25	+ 5 V
	26	+ 5 V
	24	- 12 V (RS-232-C ONLY)
	21	+ 12 V
	19	GROUND
	20	GROUND
J2	1	+ 12 V (DISPLAY POWER)
	2	+ 5 V
	3	GROUND
	4	- 12 (RS-232-C ONLY)
J4	3	RECEIVED DATA
	2	TRANSMIT DATA
	7	SIGNAL GROUND
	4	READY TO SEND
	5	CLEAR TO SEND
	20	DATA TERMINAL READY

NOTE: Unidentified pins are not connected.

WARNING: Wrong connections in any connectors or reversing J1 may cause permanent damage to the display and host interface.

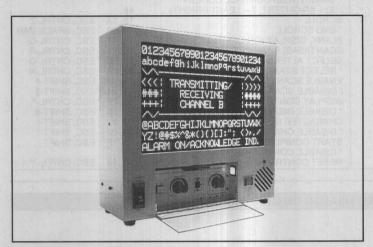
Bits													
b7	b5			A IS	- 53 - 100 - 100	0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1
	b4	b3	b2	b1	Col. Row	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	Р	,	р
	0	0	0	1	1	SOH	DC1	1	1	Α	Q	a	q
	0	0	1	0	2	STX	DC2	п	2	В	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	С	S	С	S
	0	1	0	0	4	EOT	DC4	\$	4	D	Т	d	t
	0	1	0	1	5	ENQ	NAK	%	5	Е	U	е	u
	0	1	1	0	6	ACK	SYN	&	6	F	٧	f	V
	0	1	1	1	7	BEL	ETB	·	7	G	W	g	W
	1	0	0	0	8	BS	CAN	(8	Н	X	h	X
	1	0	0	1	9	нт	EM)	9	1	Υ	i	у
	1	0	1	0	10	LF'	SUB	*	:	J	Z	j	Z
	1	0	1	1	11	VT	ESC	+	;	K	[k	{
	1	1	0	0	12	FF	FS	,	<	L	1	1	1
	1	1	0	1	13	CR	GS	-	=	М]	m	}
	1	1	1	0	14	so	RS		>	N	٨	n	~
	1	1	1	1	15	SI	US	1	?	0	_	0	DE

RDERING INFORMATION				
DESCRIPTION	PART NO.			
Display, Drive Electronics plus Controller Board (includes DC-DC converter)	APD-240M026A-1			
Display and Drive Electronics Only				
Parallel Data Connector Kit				
Power Connector Kit				
Non-Glare Filter (amber circular polarized) - other filters available - contact factory				

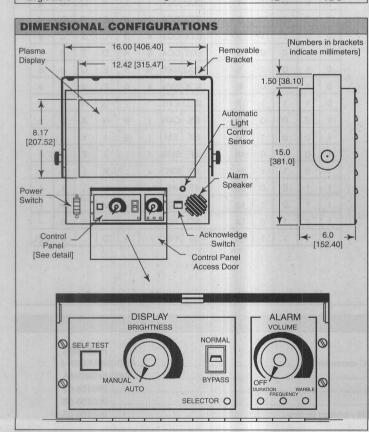
MODEL APD-250M060 Plasma Panel Display Monitors



250 Character Display/Drive Electronics/Controller/ Audio Alarm/Enclosure/Illuminated Control Panel



STANDARD ELECTRICAL SPECIFICATIONS						
	MIN.	TYP.	MAX.	UNITS		
Voltage	102	120	138	VAC		
Current			0.75	Α		
Frequency	57	60	63	Hz		
Interface Per RS-232D						
Logic One	3		12	VDC		
Logic Zero	-3	14 <u>- 16</u>	-12	VDC		



The APD-250M060 monitor displays up to 250 alphanumeric 7 x 9 dot matrix characters arranged in 10 lines of 250 characters each. Its large characters and high brightness and viewing angle makes it ideal for long distance viewing. Up to 8 monitors can be daisy chained with messages sent to all or specific units. Interfacing is via RS-232D with no handshaking. User controls are power, self test, auto/manual brightness, I/O bypass, alarm volume control and alarm acknowledge. It can serve as a status indicator and/or alarm for security systems building management, factory floor annunciation, machine control or any other system requiring a self-contained monitor with provisions for acknowledgment of alarm conditions by the operator.

FEATURES

- · High brightness Sunlight readable
- Auto/Manual brightness control
- · Wide viewing angle
- · Large character size
- · Fully self contained
- · Can be daisy chained
- Audible alarm
- Simple RS-232D interface
- Compact size

MECHANICAL SPECIFICATIONS

Dimensions: 16" [406.40] W x 15" [381.0] H

x 6" [152.40] D.

Weight: 30 pounds [13.61 kilogram].

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.
Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-80% R.H. non-condensing.

OPTICAL SPECIFICATIONS

Viewing Area: 12.42" [315.47] W x 8.17" [207.52] H.

Number of Characters: 250.

Character Size: .420" [10.67] W x .610" [15.49] H.

Luminance: 50 foot lamberts maximum

(through the filter).

Contrast Ratio: 3:1 minimum at 2000 fc ambient.

Color: Neon orange.

Viewing Angle: 120° cone.

AUDIO SPECIFICATIONS

Sound Pressure: 60 to 85 dbA at 3 feet (1 meter).

Warble: Two alternating tones.

MODEL APD-250M060

GENERAL DESCRIPTION

The APD-250M060 monitor consists of 250 character DC plasma display panel, drive circuitry, display controller, audible alarm, enclosure and illuminated control panel. The enclosure may be mounted on a flat surface or in a suspended configuration. Its large characters, wide viewing angle and high brightness (with an auto or manual brightness control) provides excellent visibility in a wide range of ambient light conditions from total darkness to bright sunlight.

Interfacing is via RS-232D at 9600 baud with no handshaking (a FIFO buffer is used to capture data when the display is busy). The byte format is 1 start bit, 8 data bits and 1 stop bit. As each monitor receives a data byte, it automatically sends it to the next unit in the daisy (up to 8 monitors maximum) chain. Returning data from the monitors are handled in the same way. A front panel bypass switch is provided to allow the operator to instantly route the input channel to the output channel in the event of a monitor failure.

Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling or inserting lines and characters. The character generator is an 8K x 8 bit EPROM which has capacity for two 256 character sets. It is preprogrammed with two ASCII character sets (128 characters each including control codes). Other character sets may be factory programmed per the user's special requirements.

The audio alarm operation is under the complete control of the host system. The alarm is a warble of two tones which can be user adjusted. The volume may be adjusted by the operator from 65 to 85 dbA by a front panel control.

User controls are power, self test, auto/manual brightness adjustment, I/O bypass, alarm volume control and alarm acknowledge.

The APD-250M060 monitor is a DTE device and will operate with a host that is either a DTE or DCE type device. Interface is through standard DB25, RS-232D connectors.

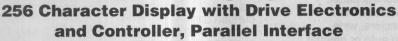
CONNECTOR	DINI	CICNIAL		
CONNECTOR	PIN	SIGNAL		
J1	1	Ground (Shield)		
	2	Transmit Data		
	3	Receive Data		
	7 38 310 310	Ground		
	4, 5, 6, 8-25	No connection		
J2	1	Ground (Shield)		
	2	Receive Data		
	3	Transmit Data		
	7	Ground		
	4, 5, 6, 8-25	No Connection		

host system.

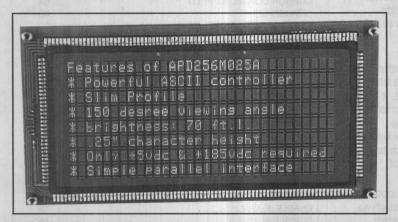
MONITOR FUNCTION SUMMARY	
CONTROL CODES	DATA
NO OPERATION	00
BELL MAN AND THE PROPERTY OF T	07
CURSOR LEFT	08
CURSOR RIGHT	09
CURSOR DOWN/LINE FEED	0A
CURSOR UP	0B
CLEAR SCREEN AND CURSOR HOME	OC
CARRIAGE RETURN	0D
CURSOR HOME	0E
CHARACTER INSERT	0F
CHARACTER DELETE	10
ALTER CURSOR COLUMN POSITION	11
CURSOR COLUMN ADDRESS (0-18)	##
CURSOR ON	12
ALTER CURSOR ROW POSITION	13
CURSOR ROW ADDRESS (0-9)	##
CURSOR OFF	14
START OF BLINK FIELD	15
LINE INSERT	16
LINE DELETE	17
END OF BLINK FIELD	18
ENABLE ALARM	19
DISABLE ALARM	1A
POLL	1C
BROADCAST TO ALL MONITORS	1D
MONITOR SELECT	1E
ID NUMBER (0-7)	nn
DESELECT ALL MONITORS	1F
ESCAPE CONTROL CODES	
ERASE TO END OF LINE	1B,0D
ERASE TO END OF SCREEN	1B,18
ERASE LINE	1B,13
ERASE LINE AND CARRIAGE RETURN	1B,25
SCROLL MODE	1B,1A
OVERWRITE OF LAST SCREEN CHARACTER	1B,1C
AUTO WRAP	1B,20
BLANK MONITOR/SCREEN SAVER	1B,11
UNBLANK MONITOR	1B,12
SELECT ALTERNATE CHARACTER SET *SELECT STANDARD CHARACTER SET	1B,0F
DISPLAY CONTROL CHARACTERS	1B,0E
*DISABLE CONTROL CHARACTERS DISPLAY	1B,1E
START CONFIDENCE TEST	1B,26
*DISABLE CONFIDENCE TEST (ANY CODE)	1B,1F
RESET	00
NEOLI	1B,19
* Indicates power up condition.	
All codes are hexadecimal format.	

ORDERING INFORMATION	
DESCRIPTION	PART NUMBER
Complete Display Monitor and Alarm System	APD-250M060

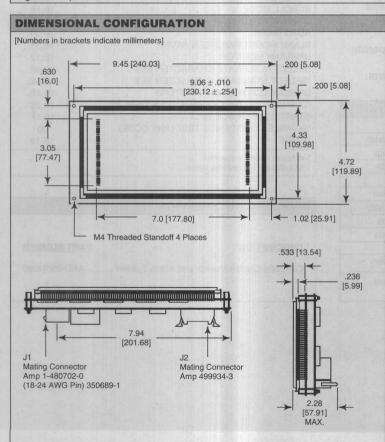
MODEL APD-256M025A Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	٧
Logic Supply Current	- Jan	.85	TOTAL TOTAL OF	A
Panel Supply Voltage	+ 180	+ 185	+ 190	V
Panel Supply Current			0.1	Α
Logic One Voltage	2.4		5.5	V
Logic Zero Voltage			0.8	V
Logic Zero Input Current	Will Hall	enti-cul	- 0.4	mA



The APD-256M025A display module displays up to 256 alphanumeric 5 x 7 dot matrix characters arranged in 8 lines of 32 characters each. The module includes drive electronics. a controller consisting of refresh memory, character generator and control logic with ASCII input. Interfacing is very simple (over an 8 data bus) and requires minimum handshake to enable the module to serve as a cost effective direct readout device for many applications including POS terminals, industrial controls, computer peripherals, measurement instruments and office machines.

FEATURES

- 256 (8 x 32) alpha numeric characters (5 x 7 dot matrix)
- Only + 5 and + 185 VDC required
- 256 International character set (includes ASCII characters). Optional character sets available.
- · Efficient parallel interface
- Wide viewing angle (150°)
- · Rugged design/slim profile
- · Flicker free refresh, high speed data input
- High brightness
- Compatible with Babcock DP-0832-C1

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C. Relative Humidity: 10-90% R.H. non-

condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018" [.457] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.0" [177.80] W x 3.05" [77.47] H.

Number of Characters: 256.

Character Size: .146" [3.71] W x .252" [6.40] H.

Luminance: 70 foot lamberts.

MODEL APD-256M025A

GENERAL DESCRIPTION

The APD-256M025A plasma display module consists of a multiplexed DC plasma display, driver circuitry and a microprocessor-based controller board. The interface is a basic 8 bit parallel ASCII interface with handshaking and some dedicated control lines. The system microprocessor handles input data rates up to 10 kHz. Dale's patented open construction display technology assures a stable, flicker free screen.

The ASCII data and cursor data are presented to the unit in negative logic convention and a separate strobe line for each determines which is entered. A single busy signal indicates to the host system when the display is busy.

The EPROM based character generator is programmed with an international character set which includes the standard ASCII characters. It can be factory or user programmed for other character sets.

The logic input is one 74LS type input with a 4.75 kilohm to + 5 VDC and a 1000 pF capacitor to ground. The output is driven from a 74LS06 open collector gate and is not internally pulled up.

INTERFACE SIGNAL DESCRIPTION

DB0-DB7 (Data bus) - Data bus to enter character and cursor data.

CUR-LD (Cursor Load) - The cursor is moved to the address given by DB0-DB7 where:

00 = home position.

1F = last character, 1st line. E0 = first character, 8th line.

FF = last character, 8th line.

WR (Write) - The character as defined by the code given by DB0-DB7 is displayed at the selected address. The display auto-increments from a given address.

CLR (Clear Command) - Display memory is cleared and the cursor goes to the HOME position (upper left corner of the screen).

CUR ON/OFF (Cursor on or off) - A logic low will display the cursor and a logic high will turn the cursor off.

BUSY (Busy Signal) - I/O is inhibited when busy is high.

PIN DESCRIPTION			
CONNECTOR	PIN	SIGNAL	
J1	1	+ 185 VDC	
	2	GROUND (H)	
	3	GROUND(L)	
	4	+ 5 VDC	
J2	1, 3, 5, 7 , 9, 11, 13, 15	DB0-DB7	
	2,4,6	NO CONNECTION	
	8	BUSY	
	10	CUR ON/OFF	
	12	CLR	
	14	WR	
	16	CUR-LD	

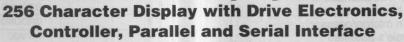
WARNING: Wrong connections or reversing J2 may cause permanent damage to the display and host system.

0	31
32	63
64	95
96	127
128	159
160	191
192	223
224	255

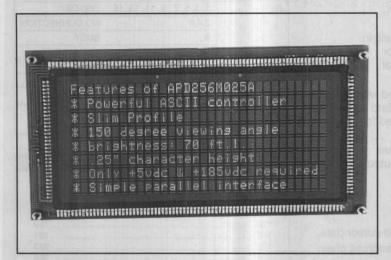
INPUT FUNCTION TABLE			
CUR-LD	WR	CLEAR	FUNCTION
L	ыаН	Н	Select a cursor address with DB0-DB7
Н	L	Н	DB0-DB7 ASCII character loaded at cursor address, increment address
Н	Н	L	Erase display and go to the home position

DESCRIPTION	PART NUMBER
Display, Drive Electronics and Controller	APD-256M025A
Parallel Data Connector Kit	280105-02
Power Connector Kit	
Non-Glare Filter (amber circular polarized) - other filters available - contact factory	280109-14

MODEL APD-256M025A-1 Plasma Panel Display Modules







consisting of refresh memory, character generator
and control logic with ASCII input. Interfacing
is very simple (parallel or serial) and requires
minimum handshake to enable the module to serve
as a cost effective direct readout device for many
applications including POS terminals, industrial
controls, computer peripherals, measurement
instruments and office machines.

The APD-256M025A-1 display module displays up to 256 alphanumeric 5 x 7 dot matrix characters

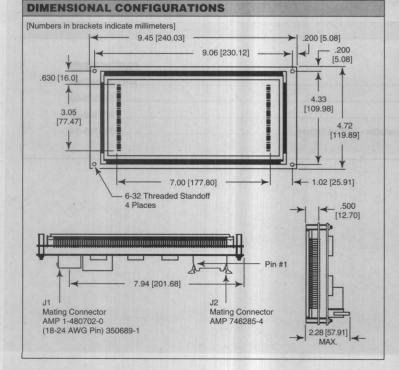
The module includes drive electronics, a controller

arranged in 8 lines of 32 characters each.

STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V
Logic Supply Current	-	0.45		Α
Panel Supply Voltage	+ 11.4	12.0	12.6	V
Panel Supply Current		0.6	1.0	Α
Logic One Voltage	2.4		5.5	V
Logic Zero Voltage		11112-333	0.8	٧
Logic Zero Input Current	110		- 0.4	mA

FEATURES

- 256 (8 x 32) alphanumeric characters (5 x 7 dot matrix)
- Only + 5 and + 12 VDC required
- 256 International character set (includes ASCII characters). (Optional character sets available.)
- Parallel interface
- Serial interface (RS-232 or TTL)
- Wide viewing angle (150°)
- · Rugged design/slim profile
- · Flicker free refresh, high speed data input
- High brightness



ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. **Storage Temperature:** - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing. Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: 0.018 [0.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.00" [177.80] W x 3.05" [77.47] H.

Number of Characters: 256.

Character Size: 0.146" [3.71] W x 0.252" [6.40] H.

Luminance: 70 foot lamberts.

MODEL APD-256M025A-1

GENERAL DESCRIPTION

The APD-256M025A-1 plasma display module consists of a multiplexed DC plasma display, driver circuitry and a microprocessor-based controller board. Dale's® patented open construction display technology assures a stable, flicker free screen.

The parallel interface is a basic 8 bit parallel ASCII interface with handshaking and some dedicated control lines. The ASCII data and command data are presented to the unit in positive logic convention. Data is entered by first placing the data to be strobed into the display on the data bus. A negative going strobe of 200 nS on the WRITE pin will notify the controller that data is available. The controller will respond with a positive going BUSY signal that will remain a logic one until the controller is ready. The system microprocessor handles input data rates up to 10 kHz.

Data format for serial interface is 1 start bit, 8 data bits and 1 stop bit. Baud rates from 150 to 19,200 can be selected. The serial interface can be programmed for RS-232 or TTL voltage levels. The display can operate with no handshaking at the highest baud rate, as it has a 20 character buffer to capture data while doing long commands. However, it is important to note instruction execution times to prevent loss of data in the event that several long commands are placed in sequence.

The EPROM based character generator is programmed with an international character set which includes the standard ASCII characters. It can be factory or user programmed for other character sets.

The logic input is one HCT type input with a 4.75 kilohm to + 5 VDC. The output is driven from a 74LS06 open collector gate and is not internally pulled up.

INTERFACE SIGNAL DESCRIPTION

DB0-DB7 (Data Bus) - Data bus to enter character and cursor data.

WRITE - A negative going strobe of 20 nS (minimum) notifies the display that data is present on the data bus.

BUSY (Busy Signal) - I/O is inhibited when busy is high.
SERIAL DATA - Input for serial data (RS-232 or TTL voltage levels). Note - Voltage levels must be jumper selected.
Application of RS-232 voltages with the jumper set for TTL levels will damage the display.

OPERATING MODE DESCRIPTION

DC1 - (Overwrite Mode) The cursor advances automatically when character data is written. If it is at the last column in a row, it shifts to the first column of the next row.

DC2 - (Vertical Scroll Mode) The cursor advances automatically when character data is written. If it is at the last column of the last row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the first column of the last row.

PIN DESCRIPTION			
CONNECTOR	PIN	SIGNAL	
J1	1,000 1,000 1,000	+ 12 VDC	
	2	GROUND	
	3	SERIAL DATA	
	4	+ 5 VDC	
J2	1, 3, 5, 7, 9, 11, 13, 15	DB0-DB7	
	17	BUSY	
	19	WRITE	
	2, 4, 6, 8, 10, 12, 14, 16, 18, 20	GROUND	

WARNING: Wrong connections may cause permanent damage to the display and host system.

COMMAND SUMMARY				
CONTROL COMMANDS	CODE (HEX)	TIMING		
Cursor Left	08	210 μS		
Cursor Right	09	210 μS		
Cursor Down	0A	210 μS		
Cursor Up	0B	210 μS		
Clear Screen, Home Cursor	0C	6.4 mS		
Carriage Return	0D	210 μS		
Home Cursor	0E	210 μS		
Insert Character	0F	1.2 mS		
Delete Character	10	1.2 mS		
Alter Cursor Column (2 Byte)	11	190 μS		
Cursor On (Blinking Underbar)	12	190 μS		
Alter Cursor Row (2 Byte)	13	190 μS		
Cursor Invisible	14	190 μS		
Insert Line	16	2.2 mS		
Delete Line	17	2.2 mS		
Set Display to DC2 Mode	18	190 μS		
Set Display to DC1 Mode	19	190 μS		

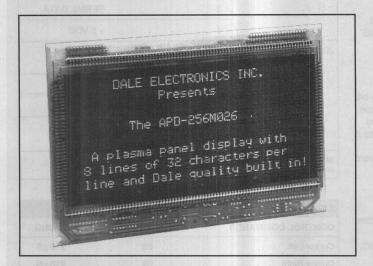
ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Display, Drive Electronics and Controller	APD-256M025A-1
Parallel Data Connector Kit	280105-04
Power/Serial Data Connector Kit	280108-06
Non-Glare Filter (amber circular polarized) - other filters available, contact factory	280109-14

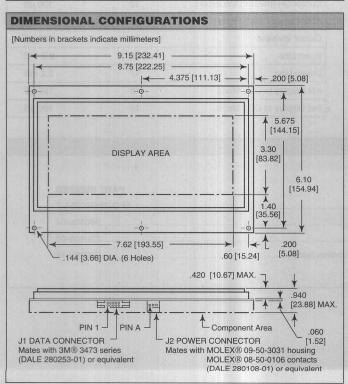
MODEL APD-256M026 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply 1 Voltage	4.75	5.0	5.25	V
Logic Supply 2 Voltage	11.40	12.0	12.60	٧
Logic Supply 1 Current	100 2 (10)	50.0	60.0	mA
Logic Supply 2 Current	20-15	60.0	75.0	mA
Panel Supply 1 Voltage	91.25	95.0	99.75	V
Panel Supply 2 Voltage	- 85.50	- 90.0	- 94.50	V
Panel Supply 1 Current		60.0	128.0	mA
Panel Supply 2 Current		80.0	135.0	mA



The APD-256M026 display module displays up to 256 alphanumeric 5 x 7 dot matrix characters arranged in 8 lines of 32 characters each. The module includes drive electronics and is easily interfaced to CRT controllers.

FEATURES

- 256 (8 x 32) alphanumeric characters (5 x 7 dot matrix plus underbar)
- .18 W x .26 H character size
- High brightness (100 foot/lamberts typical)
- Controller Board available with parallel and RS232 inputs
- Wide viewing angle (150°)
- · Easily interfaced
- Compact size

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 ms duration. 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 minutes duration along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 3.30" [83.82] W x 7.62" [193.55] L.

Number of Characters: 256.

Character Size: .18" [4.57] W x .26" [6.60] H.

Dot Size: .020" [.508] diameter.

Dot Pitch: .040" [1.016].

Character Spacing: .060" [1.52].

Scanning Rate: 70-80 Hz.

Brightness: 100 foot lamberts.

Color: Neon orange.

Viewing Angle: 150° cone.

GENERAL DESCRIPTION

The APD-256M026 consists of a DC plasma panel display and drive circuitry to accept serially entered row data and generate the required cathode and anode signals to display the desired information. The module displays information in a row scanning mode; that is, row by row beginning at the top, with each character being 5 dots wide and with 32 characters per row, 160 bits of dot information per row is supplied to the module as serial data. When all 160 bits of row information have been loaded, the data will be displayed. This process is repeated until all 64 rows (each character being 7 dots high plus underbar) have been scanned in succession. All inputs are TTL compatible.

MODEL APD-256M026

INTERFACE SIGNAL DESCRIPTION

Serial Data - The 160 bits of data that represent one row of character data is serially entered on this input. The information is entered at the 160th dot position (right side of display) and is advanced one column with each **Data Shift pulse**.

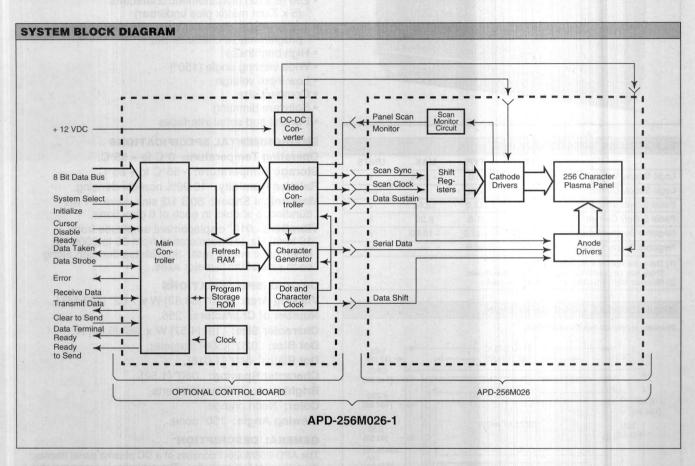
Data Shift - A negative going edge on this input enters the row data bit present at the **Serial Data** input. This input requires 160 pulses to enter the 160 bits of row data.

Data Sustain - This input blanks the display during data entry. When all 160 bits of dot data are entered, a logic low on this input displays the data.

Scan Clock - Much like horizontal sync on a CRT, this signal is used to advance the row pointer vertically down the display, one row at at time. This input must be continually pulsed whenever the display is on to prevent damage to the panel.

Scan Sync - This pulse is applied after each complete scan to begin a new scan at the top row of the panel, similar to vertical sync on a CRT.

PIN DESCRIPTION				
CONNECTOR	PIN	FUNCTION		
J1	1	DATA SHIFT		
	2	GROUND		
	3	DATA SUSTAIN		
	4	+ 12 VDC		
	5	SCAN SYNC		
	6	SCAN CLOCK		
	7_	+ 5 VDC		
	8	SCAN MONITOR		
	9	GROUND		
	10	SERIAL DATA		
J2	Α	- 90 VDC		
	В	GROUND		
	C	+ 95 VDC		



DESCRIPTION	PART NUMBER
Display and Drive Electronics	APD-256M026
Display and Drive Electronics plus Controller Board (includes DC-DC high voltage converter)	
DC-DC High Voltage Converter	PDS-300
Data Connector Kit	280253-01
Power Connector Kit	280108-01
Non-Glare Filter (amber circularly polarized) - other filters available - contact factory	280109-04

MODEL APD-256M026-1 Plasma Panel Display Modules



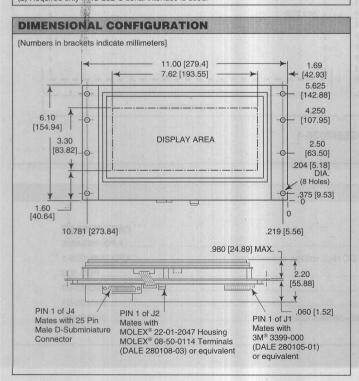




di di	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	5.0	+ 5.25	V
Logic Supply Current		700	asy <u>-</u>	mA
Panel Supply Voltage	11.40	12.0	12.60	V
Panel Supply Current (1)		1.0	2.20	Α
Negative Supply Voltage(2)	- 11.40	- 12.0	- 12.60	٧
Negative Supply Current		60.0		mA

- (1) This is the input to a DC-DC converter.
- There may be peak in rush currents higher than shown.

 (2) Required only it IS-232-C serial interface is used.



The APD-256M026-1 display module displays up to 256 alphanumeric 5 x 7 dot matrix characters arranged in 8 lines of 32 characters each. The module includes drive electronics, a microprocessor based controller consisting of refresh memory, character generator and control logic with parallel or serial interface and a DC to DC converter to develop the necessary panel voltage.

FEATURES

- 256 (8 x 32) alphanumeric characters (5 x 7 dot matrix plus underbar)
- 128 USASCII character set + 128 user programmable character set
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Software dimming
- · Parallel and serial interfaces

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 ms duration, 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 minutes duration along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 3.30" [83.82] W x 7.62" [193.55] L.

Number of Characters: 256.

Character Size: .18" [4.57] W x .26" [6.60] H.

Dot Size: .020" [.508] diameter.

Dot Pitch: .040" [1.016].

Character Spacing: .060" [1.52]. Brightness: 100 foot lamberts.

Color: Neon orange.
Viewing Angle: 150° cone.

GENERAL DESCRIPTION

The APD-256M026-1 consists of a DC plasma panel display, drive circuitry and controller. The controller is programmable to operate in a parallel or serial mode. The parallel interface is a basic 8 bit parallel interface with hand-shaking and some dedicated control lines. The serial interface is RS-232-C compatible with 8 selectable baud rates and 2 bit formats. Single byte and two byte commands allow simplified code generation, yet accomplish complex display tasking such as scrolling, or inserting lines and characters.

The character generator is a 4K x 8 bit EPROM and is capable of storing two 128 character sets. The standard set consists of 128 USASCII characters (including control codes). An alternate set of 128 characters can be user programmed.

A DC-DC converter generates the required display voltage from + 12 VDC, and all input lines are LSTTL compatible with 6.8 kilohm pull-up resistors to Vcc.

MODEL APD-256M026-1

FUNCTION SUMMARY					
CONTROL CODES	HEX	ASCII	CONTROL CODES	HEX	ASCII
CURSOR HOME	0E	CNTRL-N	ERASE TO END OF LINE	1B,0D	ESC, CNTRL-M
CARRIAGE RETURN	0D	CNTRL-M	ERASE TO END OF SCREEN	1B, 18	ESC, CNTRL-X
LINE FEED	OA	CNTRL-J	ERASE LINE	1B, 13	ESC, CNTRL-S
CURSOR UP	0B	CNTRL-K	ERASE LINE & CARRIAGE RETURN	1B, 25	ESC, CNTRL-%
CURSOR DOWN	OA	CNTRL-J	ALTER BRIGHTNESS	1B, 0C	ESC, CNTRL-L
CURSOR RIGHT	09	CNTRL-I	BRIGHTNESS CONTROL CODES:		
CURSOR LEFT	08	CNTRL-H	(0 = BRIGHTEST, 7 = LEAST BRIGHT)	##	
ALTER CURSOR CHARACTER POSITION	11	CNTRL-Q	SCROLL	1B, 1A	ESC, CNTRL-Z
CURSOR POSITION ADDRESS	##		* END SCROLL	1B, 20	ESC, SPACE BAR
ALTER CURSOR ROW POSITION	13	CNTRL-S	BLANK DISPLAY (ON/OFF ALTERNATELY)	1B, 11	ESC, CNTRL-Q
CURSOR ROW ADDRESS	##		SCAN DISABLE (ON/OFF ALTERNATELY)	1B, 12	ESC, CNTRL-R
CURSOR ON	12	CNTRL-R	SELECT ALTERNATE CHARACTER SET	1B, 0F	ESC, CNTRL-O
CURSOR OFF	14	CNTRL-T	* SELECT STANDARD CHARACTER SET	1B, 0E	ESC, CNTRL-N
ALTER CURSOR FORMAT	15	CNTRL-U	ENABLE SCAN DISABLE TIMER	1B, 23	ESC. SHIFT-#
CURSOR FORMAT CODE:			* DISABLE SCAN DISABLE TIMER	1B, 24	ESC, SHIFT-\$
FULL BLOCK, NO BLINK	00		DISPLAY CONTROL CHARACTERS	1B, 1E	ESC, CNTRL-^
NO OPERATION	00	CNTRL-@	* DISABLE DISPLAY CONTROL CHARACTERS	1B, 26	ESC, SHIFT-&
CLEAR SCREEN	OC	CNTRL-L	CHARACTER BLINK	1B, 21	ESC, SHIFT-!
CHARACTER INSERT	OF	CNTRL-O	* DISABLE CHARACTER BLINK	1B, 22	ESC, SHIFT-"
CHARACTER DELETE	10	CNTRL-P	START CONFIDENCE TEST	1B, 1F	ESC, SHIFT-
LINE INSERT	16	CNTRL-V	* DISABLE CONFIDENCE TEST (ANY CODE)	##	
LINE DELETE	17	CNTRL-W	RESET CONTROLLER (TO INITIAL STATE)	1B, 19	ESC, CNTRL-Y

CONNECTOR	PIN	SIGNAL
J1 teau	9	DATA BIT 1 (LSB)
	3-	DATA BIT 2
	6	DATA BIT 3
	7	DATA BIT 4
	5	DATA BIT 5
	4	DATA BIT 6
	2	DATA BIT 7
	1	DATA BIT 8 (MSB)
	10	CURSOR DISABLE
	12	ERROR
	13	READY
	15	DATA STROBE
	16	INITIALIZE
	17	DATA TAKEN
	22	SYSTEM SELECT
	25	+ 5 V
	26	+ 5 V
	24	- 12 V (RS-232-C ONLY)
	21	+ 12 V
	19	GROUND
100	20	GROUND
J2	1	+ 12 V (DISPLAY POWER)
	2	+5 V
	3	GROUND
	4	- 12 V (RS-232-C ONLY)
J4	3	RECEIVED DATA
	2	TRANSMIT DATA
	7	SIGNAL GROUND
	4	READY TO SEND
	5	CLEAR TO SEND
	20	DATA TERMINAL READY

ORDERING INFORMATION

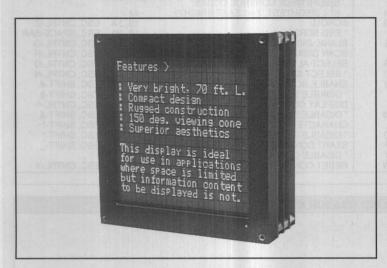
Bits													
b7						0	0	0	0	1 0	1 0	1	1
100	b5					0	1	0	1	0	1	0	
	b4	b3	b2	b1	Col.	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	Р	koʻu u	р
	0	0	0	1	1 80	SOH	DC1	!	1	А	Q	a	q
	0	0	1	0	2	STX	DC2	п	2	В	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	С	S	С	S
	0	1	0	0	4	EOT	DC4	\$	4	D	T	d	t
	0	1	0	1	5	ENQ	NAK	%	5	Е	U	е	u
	0	1	1	0	6	ACK	SYN	&	6	F	٧	f	V
	0	1	1	1	7	BEL	ETB	- 6	7	G	W	g	W
	1	0	0	0	8	BS	CAN	(8	Н	X	h	Х
	1	0	0	1	9	HT	EM)	9	-1	Υ	i	У
	1	0	1	0	10	LF	SUB	*	:	J	Z	j	Z
	1	0	1	1	11	VT	ESC	+	;	K	[k	{
	1	1	0	0	12	FF	FS	,	<	L	1	1	1
	1	1	0	1	13	CR	GS	_	=	М]	m	}
	1	1	1	0	14	so	RS		>	N	^	n	~
	1	1	1	1	15	SI	US	1	-?	0	18.5	0	DEL

DESCRIPTION	PART NO.
Display, Drive Electronics plus Controller Board (includes DC-DC converter)	APD-256M026-1
Display and Drive Electronics Only	
Parallel Data Connector Kit	280105-01
Power Connector Kit	
Non Glaro Filter (amber circular polarized) other filters quallable context factors	000100 01

MODEL APD-336M019/-2 **Plasma Panel Display Modules**

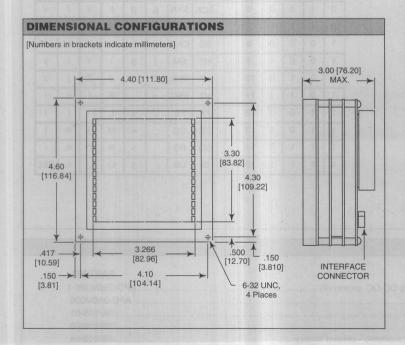






Ex la le violet	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	4.75	5.0	5.25	V
Logic Supply Current	_	0.5		А
Panel Supply Voltage	14.25	15.00	15.75	V
Panel Supply Current *	TO HE OTHER	0.5	400	Α
Logic One Voltage	2.0	21 - 5	11 - 10	V
Logic Zero Voltage	a tento		0.8	V
Logic Zero Input Current			- 0.4	mA

* This is the input to a DC/DC converter. There may be peak in-rush currents higher than shown.



The APD-336M019 display module displays up to 336 alphanumeric 5 x 7 dot matrix characters arranged in 14 lines of 24 characters each. The module includes drive electronics, a controller consisting of refresh memory, character generation and control logic to enable the module to serve as a direct readout device for many applications. A DC/DC converter is also included to develop the necessary panel voltage from + 15 VDC (other input voltages available).

FEATURES

- 336 (14 x 24) alphanumeric characters (5 x 7 dot matrix)
- 128 USASCII character set plus 128 user programmable character set
- · Parallel interface
- High brightness
- Wide viewing angle (120°)
- Low input voltage
- · Minimal footprint

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. APD-336M019-2: - 15°C to + 70°C. (Life may be shortened when subjected to operation below 0°C.)

Storage Temperature: - 55°C to + 85°C. Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 sine wave. 11 msec duration. Five shocks in each of six directions.

Vibration: 0.018" displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 3.28" [83.31] W x 3.31" [84.07] L.

Number of Characters: 336.

Character Size: 0.105" [2.67] W x .193" [4.90] H.

Pixel Pitch:

0.023" [.584] horizontal. 0.030" [.762] vertical.

Luminance: 80 foot lamberts maximum.

Color: Neon orange.

Viewing Angle: 120°C cone.

PIN DESCRIPT	ION
PIN	DESCRIPTION
1, 2, 3, 4	UNUSED
5	DATA BIT 0
6	DATA BIT 1
7	DATA BIT 2
8	DATA BIT 3
9	DATA BIT 4
10	DATA BIT 5
11	DATA BIT 6
12	DATA BIT 7
13	CURSOR DISABLE
14	BLS
15	RS0
16	RS1
17	E tom mile vin sess
18	US
19	R/W
20	+ 5 VDC
21, 23, 25	GND (all inputs must be connected)
22, 24, 26	+ 15 VDC (all inputs must be connected)

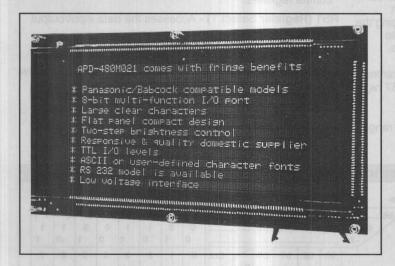
6			No.			0	0	0	0	1	1	1	1
b5 _	b4					0	0		1	0	0	1 0	1
	b3	b2	b1	b0	Col.	0	1	2	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	Р	,	р
	0	0	0	1	1.97	SOH	DC1	!	1	Α	Q	a	q
	0	0	1	0	2	STX	DC2	п	2	В	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	С	S	С	s
	0	1	0	0	4	EOT	DC4	\$	4	D	Т	d	t
	0	1	0	1	5	ENQ	NAK	%	5	Е	U	е	u
	0	1	1	0	6	ACK	SYN	&	6	F	٧	· f	V
	0	1	1	1	7	BEL	ETB	6	7	G	W	g	W
	1	0	0	0	8	BS	CAN	(8	Н	X	h	х
	1	0	0	1	9	НТ	EM)	9	1	Υ	i	у
	1	0	1	0	10	LF	SUB	*	:	J	Z	j	Z
	1	0	1	1	11	VT	ESC	+	;	K	[k	{
	1	1	0	0	12	FF	FS	,	<	L	\	1	!
	1	1	0	1	13	CR	GS	_	=	М]	m	}
	1	1	1	0	14	so	RS	1	>	N	٨	n	~
	1	1	1	1	15	SI	US	1	?	0	10	0	DE

DESCRIPTION	PART NUMBER
Display, Driver Electronics, Controller, with DC/DC Convertor	APD-336M019
Display, Drive Electronics, Controller, with DC/DC Convertor and Extended Operating Temperature Range	APD-336M019-2
Interface Connector Kit	280105-01
Non-Glare Filter (amber circular polarized) - other filters available - contact factory	280109-08

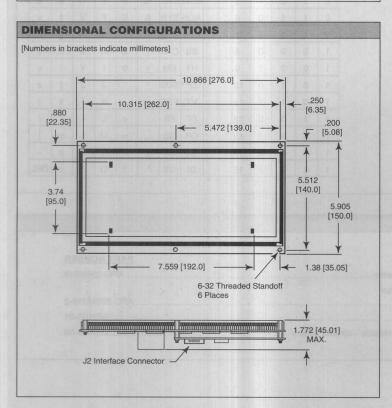
MODEL APD-480M021-1 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS							
DA TALOTALIS	MIN.	TYP.	MAX.	UNITS			
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	V			
Logic Supply Current	The state of the		750	mA			
Panel Supply Voltage	11.4	12.0	12.6	V			
Panel Supply Current		.7	2.5	А			



The APD-480M021-1 display module displays up to 480 alphanumeric 5 x 7 dot matrix characters arranged in 12 lines of 40 characters each.

The module includes drive electronics, a controller consisting of refresh memory, character generator and control logic with an ASCII one line RS-232 compatible interface to enable the module to serve as a direct readout device for many applications including POS terminals, industrial controls, computer peripherals, measurement instruments, and office machines.

(A Parallel Interface version is available - APD-480M021/-2).

FEATURES

- 480 (12 x 40) alphanumeric characters (5 x 7 dot matrix)
- Only + 5 and + 12 VDC required
- ASCII character set (optional character sets available)
- · Efficient serial interface
- Two step brightness control
- Wide viewing angle (150°)
- · Rugged design/slim profile
- · Flicker free refresh
- Editing functions

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% R.H. non-condensing.

Mechanical Shock: 50G sine wave, 11 msec
duration, 5 shocks in each of 6 directions.

Vibration: .018" displacement amplitude from 10 to 50 Hz, 2 G acceleration from 50 to 2000 Hz logarthmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.56" [192.02] W x 3.74" [95.00] H.

Number of Characters: 480.

Character Size: 0.146" [3.708] W x .209" [5.309] H.

Luminance: 60 foot lamberts.

Color: Neon orange.

Viewing Angle: 150° cone.

MODEL APD-480M021-1

GENERAL DESCRIPTION

The APD-480M021-1 consists of a DC plasma panel display, drive circuitry and controller. The interface is through a single 4 pin power connector that only requires + 5 VDC, + 12 VDC, Ground and Serial Data inputs. Handshaking is not required as a 20 byte FIFO buffer is used to capture data when the display is busy. Dale's® patented open construction display technology assures a stable, flicker free screen.

The controller maintains all the refresh memory, character generation and control logic. Various editing functions are available such as scrolling, inserting and deleting characters. The module can also be dimmed or blanked for screen highlighting. Serial data protocol is 8 data bits, no parity, 1 start bit and 1 stop bit. Baud rate (300, 1200 or 9600) is selected with a control board jumper. A self test can be manually performed by removing a jumper.

The EPROM based character generator is programmed with an ASCII character set, but is easily configured for any character set.

PIN DESCRI	PTION	
CONNECTOR	PIN	SIGNAL
J2	1	+ 5 V
	2	SERIAL DATA
	3	GND
	4	+ 12 VDC

WARNING: Wrong connections or reversing J2 may cause permanent damage to the display and host interface.

COMMAND DESCRIPTION	
04H: Set display to full brightness	5.

05H: Set display to half brightness.

06H: Unblank Display - Restores screen information previously blanked with Blank Display command.

07H: Blank Display - Blanks screen without losing data.

08H: Cursor Left (Back Space).

09H: Cursor Right (Horizontal Tab).

OAH: Cursor Down (Line Feed).

0BH: Cursor Up (Vertical Tab).

OCH: Clear Screen, Home Cursor.

0DH: Carriage Return.

0EH: Cursor Home.

0FH: Insert Character.

10H: Delete Character.

11H: DC1 MODE (Default Display Mode) - Cursor shifts one character to the right automatically when character data is written. If the cursor is at the right end of a row, it shifts to the leftmost end of the next row.

12H: DC2 MODE (Vertical Scroll Mode) - When the Cursor reaches the right end of the bottom row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the left end of the bottom row.

13H: DC3 MODE (Default Cursor Mode) - Cursor is turned on.

14H: DC4 MODE - Cursor is turned off.

15H: DC5 MODE - Cursor is turned on and blinks at 4 Hz.

16H: Line Insert.

17H: Line Delete.

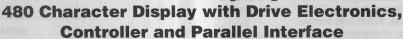
18H: Cursor position - The cursor position may be defined by 2 bytes of data after the Cursor Position command. The first byte defines the row, and the second byte the column.

COMN	IAND EXECUTION TIM	ING
CODE	DESCRIPTION	TIMINO
04H	Set Full Brightness	190 μS
05H	Set Half Brightness	190 μS
06H	Unblank	190 μS
07H	Blank Display	190 μS
08H	Cursor Left	210 μS
09H	Cursor Right	210 μS
0AH	Cursor Down	210 μS
овн	Cursor Up	210 μS
0CH	Clear Screen, Cursor Home	6.4 μS
0DH	Carriage Return	210 μ5
0EH	Cursor Home	210 μ5
0FH	Insert Character	1.2 mS
10H	Delete Character	1.2 mS
11H	DC1 Mode	190 μ
12H	DC2 Mode	190 μ8
13H	DC3 Mode	190 μ
14H	DC4 Mode	190 μ
15H	DC5 Mode	190 μ
16H	Line Insert	2.2 mS
17H	Line Delete	2.2 mS
18H	Cursor Position	190 μ
i	Y Position	120 μ
271	X Position	120 μ5

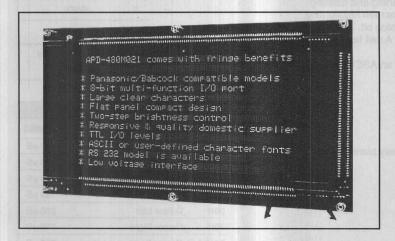
ORDERING INFORMATION

Display, Drive Electronics, Controller APD-480M021-1 Interface Connector Kit 280108-05	DESCRIPTION	PART NUMBER
Interface Connector Kit	Display, Drive Electronics, Controller	APD-480M021-1
	Interface Connector Kit	280108-05
Non-Glare Filter (amber circular polarized) - other filters available, contact factory	Non-Glare Filter (amber circular polarized) - other filters available, contact factory	

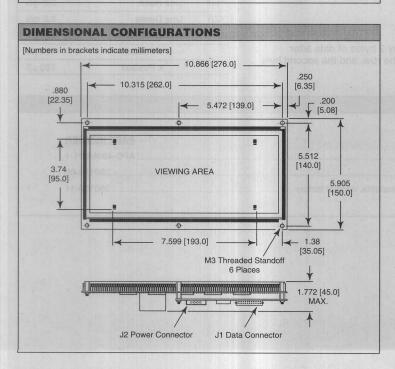
MODEL APD-480M021/-2 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS				
YEAR STREET STREET	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	4.75	5.0	5.25	V
Logic Supply Current	Hi sha m ir sa	800		mA
Panel Supply Voltage	180.0	185.0	190.0	V
Panel Supply Current	S and the same of	ma-60	105.0	mA
Logic One Voltage	2.2		5.0	V
Logic Zero Voltage		- <u>-</u>	0.8	٧
Logic Zero Input Current			- 0.4	mA
(APD-480M021-2)				
Panel Supply Voltage	11.4	12.0	12.6	V
Panel Supply Current		0.7	2.5	А



The APD-480M021 display module displays up to 480 alphanumeric 5 x 7 dot matrix characters arranged in 12 lines of 40 characters each.

The module includes drive electronics, a controller

consisting of refresh memory, character generator and control logic with ASCII input to enable the module to serve as a direct readout device for many applications including POS terminals, industrial controls, computer peripherals, measurement instruments, and office machines.

(A serial interface version is available - APD-480M021-1.)

FEATURES

- 480 (12 x 40) alphanumeric characters (5 x 7 dot matrix)
- Only + 5 and + 12 VDC required (- 2 option)
- ASCII character set (optional character sets available)
- Efficient Parallel Interface
- Two Step Brightness Control
- Wide viewing angle (150°)
- Rugged design/slim profile
- Flicker free refresh
- Editing functions
- Panasonic/NEC/Babcock Compatible

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-90% non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration. 5 shocks in each of six directions.

Vibration: 0.018" [.46] displacement amplitude from 10 to 50 Hz acceleration from 50 to 2000 Hz logarthmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.56" [192.02] W x 3.74" [95.0] H.

Number of Characters: 480.

Character Size: 0.146" [3.708] W x .209" [5.309] H.

Luminance: 60 foot lamberts.

MODEL APD-480M021/-2

GENERAL DESCRIPTION

The APD-480M021 consists of a DC plasma panel display, drive circuitry, and controller. The interface is a basic 8 bit parallel ASCII interface with handshaking and some dedicated control lines. Dale's® patented open construction display technology assures a stable, flicker free screen.

The controller maintains all the refresh memory, character generation and control logic. It supports back space, horizontal tab, line feed, vertical tab, clear, carriage return and escape through software instructions. Control commands available include reading cursor position and data, horizontal tab after reading data at cursor position, character insert, character delete, line insert, line delete and screen clear. Operating modes are "normal" (wrap-around) or vertical scroll. The cursor may be turned on, or off, or on with a 4 Hz blink rate.

The EPROM based character generator is programmed with an ASCII character set, but is easily configured for any character set.

The logic input is one 74LS type input with 4.75 kilohm to + 5 VDC. All input lines also have a 1000 µF capacitor to ground.

INTERFACE SIGNAL DESCRIPTION

DB0-DB7 (Data Bus) - Tri-state bi-directional data bus to exchange data between display and host processor.

CHK (Check Command) - If CHK is low, any character written will fill all positions on the screen. After CHK is low, momentarily pulling CLR low will start a self-test where all the characters in the character set are scrolled from right to left.

WR (Write) - Enter data while WR is low.

RD (Read) - Read data while RD is low.

A0 (Address Bus) - Selects character control codes or control command. A0 = low enables writing data.

US (Unit Select) - Read and Write commands will only influence display while US is low

B/D (Brightness/Dim) - Brightness is reduced 50% when B/D is low.

BL (Blank Screen) - Screen blanked when BL is low, but the data and cursor are maintained.

CLR (Clear Display) - Display memory is cleared and the cursor goes to the HOME position when CLR is low.

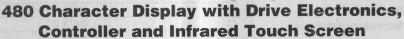
BUSY (Busy Signal) - I/O is inhibited while BUSY is high. This output is driven from a 74LS06 open collector output and is not pulled up.

PIN	DESCRIPTION		
J1 DATA CONNECTOR	(
him velerithma	DATA BIT 0		
3	DATA BIT 1		
5	DATA BIT 2		
7	DATA BIT 3		
9	DATA BIT 4		
11	DATA BIT 5		
13	DATA BIT 6		
15	DATA BIT 7		
17	WR		
19	US		
21	RD		
23	CLR		
2, 26	GND		
4	B/D		
6	A0		
12	CHK		
24	BUSY		
25	BL		
8, 10, 14, 16, 18, 20, 22	Unused		
J2 POWER CONNECTOR			
1	+ 185 V (+ 12 with - 2 option		
2	GND (Power)		
3	GND (Logic)		
4 + 5 V			

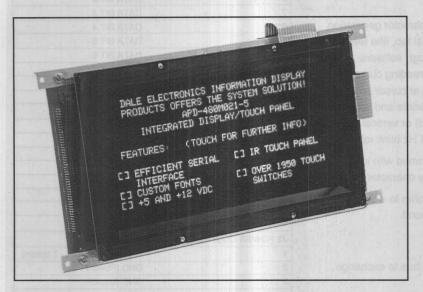
CONTROL CODES	HEX
Back Space	08
Horizontal Tab	09
ine Feed	0A
/ertical Tab	0B
Clear	0C
Carriage Return	0D
Read Cursor Position	F0
Read Data at Cursor Position	F1
Read Cursor Position Data, then Perform Horizontal Tab	F2
Character Insert	F3
Character Delete	F4
ine Insert	F5
ine Delete	F6
Screen Clear	FF
SCAPE CONTROL CODES	The County I is
Iter Cursor Position	1B
Row Position	##
Column Position	##

ORDERING INFORMATION DESCRIPTION PART NUMBER Display, Driver Electronics and Controller APD-480M021 Display, Driver Electronics, Controller with Built-in DC/DC Converter Parallel Data Connector Kit Power Connector Kit

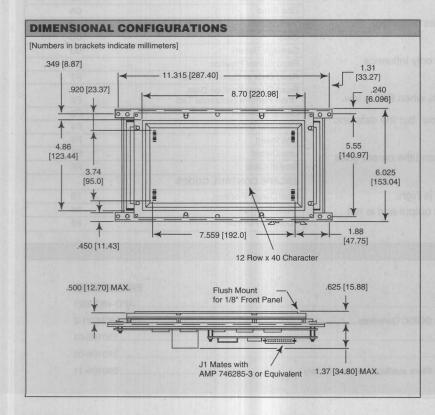
MODEL APD-480M021-5 Plasma Panel Display Modules







STANDARD ELECTRICAL SPECIFICATIONS				
	MIN.	TYP.	MAX.	UNITS
Logic Supply Voltage	+ 4.75	+ 5.0	+ 5.25	٧
Logic Supply Current	-	750		mA
Panel Supply Voltage	11.4	12.0	12.6	V
Panel Supply Current		.7	2.5	Α



The APD-480M021-5 display module displays up to 480 alphanumeric 5 x 7 dot matrix characters arranged in 12 lines of 40 characters each. It includes drive electronics, a microprocessor based controller, plus an IR touch panel and bezel. The controller maintains all the refresh memory, character generation, touch input and control logic to enable the module to serve as a direct input/output device for many applications including POS terminals, industrial controls, computer peripherals, measurement instruments or any other system requiring a self contained input/output terminal.

It also controls the report of touch point coordinates from the touch panel to the host computer.

FEATURES

- 480 (12 x 40) alphanumeric characters (5 x 7 dot matrix)
- Infrared touch panel
- 63 x 31 touch point format
- All functions software accessible
- High brightness
- Wide viewing angle
- Low input voltage
- Efficient serial interface

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C. Relative Humidity: 10-90% R.H. non-

condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: .018 [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 7.56" [192.02] W x

3.74" [95.00] H.

Number of Characters: 480. Character Size: 0.146" [3.708] W x

0.209" [5.309] H.

Luminance: 40 foot lamberts (filtered).

Color: Neon orange. Viewing Angle: 150° cone.

IR Beams: 32 on X axis, 16 on Y axis.

MODEL APD-480M021-5

GENERAL DESCRIPTION

The APD-480M021-5 consists of a 480 character DC plasma display, drive electronics, RS-232 compatible serial ASCII input controller integrated with an IR touch panel and bezel to form a rugged, slim profile display I/O sub-system. Interface is through a single 15 pin D subminiature connector that has + 5, + 12 VDC, ground and serial data connections. (A DC/DC converter generates the required display voltage from + 12 VDC.)

An EPROM based character generator is easily configured for any character set. Various editing functions are available on the controller such as scrolling, inserting and deleting characters. The display module can also be dimmed or blanked for screen highlighting. DALE'S® patented open construction display technology assures a stable, flicker free screen.

The infrared touch screen consists of IR LEDS and detectors arranged to provide a grid of infrared light beams across the face of the display. If an object is present, then an intersecting pair of beams will be blocked, and the controller will determine the coordinates of that point and report it to the host computer. Using simple input commands, the touch screen can be configured to report coordinates when a stylus is entered into the touch panel, when it is removed, or continuously. Other commands are provided to allow control over the flow of touch point coordinates between the touch panel and the host computer.

INTERFACING

(See pin descriptions.) The controller is considered to be a DTE type device and will operate with a host that is either a DTE or DCE device. The serial input and output lines meet RS-232C specifications. Serial data is entered asynchronously with 3 (300, 1200 or 9600) selectable baud rates. The byte format is 1 start bit, 8 data bits and 1 stop bit.

TOUCH SCREEN COMMANDS			
COMMAND	CODE		
Enable Exit Point Mode	20H	TAN STEE	
* Disable Exit Point Mode	21H	ATTE	
Enable Enter Point Mode	22H	YXXTG	
* Disable Enter Point Mode	23H	GALL	
Enable Continous Mode	24H		
* Disable Continous Mode	25H	ottol ed	
Enable Touch Screen	27H	01010	
Request Failed Beam Report	28H	A STATE	
Enable Report Transfer	29H	nonge	
* Disable Report Transfer	2AH		
Request Report	2BH		

PIN DESCRIPTION	ON	
CONNECTOR	PIN	SIGNAL
J1	1	GROUND
	2	TRANSMIT DATA
	3	RECEIVE DATA
	4	READY TO SEND
	5	CLEAR TO SEND
	6	GROUND
	310 a10 7 m Serson	GROUND
	8	+ 5 VDC
	9	+ 5 VDC
	10	GROUND
	11	GROUND
	12	GROUND
	13	+ 12 VDC
	A STATE OF THE PARTY OF THE PAR	+ 12 VDC
	45	+ 12 VDC
	16	NC

COL	AMA	ND	JE5	CHIP	HOIT
1				1-11-11-11	

04H Set display to full brightness.

05H Set display to half brightness.

06H Unblank display - Restores screen information previously blanked with blank display command.

07H Blank display - Blanks screen without losing data.

08H Cursor left (Back space).

09H Cursor right (Horizontal tab).

0AH Cursor down (Line feed).

0BH Cursor up (Vertical tab).

0CH Clear screen, home cursor.

ODH Carriage return.

0EH Cursor home.

0FH Insert character.10H Delete character.

11H DC1 MODE (Default display mode) - Cursor shifts one character to the right automatically when character data is written. If the cursor is at the right end of a row, it shifts to the leftmost end of the part row.

12H DC2 MODE (Vertical scroll mode) - When the cursor reaches the right end of the bottom row, all screen characters shift upwards one row, pushing the top row off the screen. The bottom row is cleared and the cursor is placed at the left end of the bottom row.

13H DC3 MODE (Default cursor mode) - Cursor is turned on.

14H DC4 MODE - Cursor is turned off.

15H DC5 MODE - Cursor is turned on and blinks at 4 Hz.

16H Line insert.

17H Line delete.

18H Touch Panel Command to follow.

19H Begin character blink.

1AH End character blink.

1BH Cursor position - The cursor position may be defined by 2 bytes of data after the cursor position command. The first byte defines the row, and the second byte the column.

1CH Font select (followed by data byte).

ORDERING INFORMATION

An amber colored non circular polarized contrast filter is standard. Contact factory for other filter options.

ezTouch® Touch Panel Software

(Dale® Version)



ezTouch is a stand-alone all-in-one programming tool for software designers and programmers of touch-sensitive hardware systems integrated with the IBM PC/XT/AT and compatible computers.

ezTouch enables users to control touch frames with programs written in any language without having to create software "drivers", procedures or functions. ezTouch is a memory-resident program - once loaded by the user ezTouch is always available to control and read the touch frame, regardless of what application the computer is running. Using simple commands, programmable in any language (even issued from DOS), the user can activate ezTouch and acquire touch frame data. ezTouch places data received from the touch frame into the PC keyboard buffer. ezTouch is invoked by simply typing (at the prompt) ezTouch [/COM2], (COM1 is the default). Thus, touch choices are communicated to your program as though they were typed at the keyboard.

ezTouch provides a fast, easy method of creating touch-active areas (targets), specifying plain text strings that are put into the keyboard buffer when the target is touched. Targets therefore return simple descriptive strings (of the user's choice) instead of numerical coordinates. For example: Touched targets could return "ON", "OFF", "CLOSE VALVE" AND "BEGIN VIDEO", to a program. ezTouch therefore makes any code much more writable, readable and maintainable than ordinary touch software methods.

ezTouch comes with additional commands to control screen displays, and to display screens and windows created with the SAYWHAT?! LIS screen storage standard. ezTouch includes a completely compatible superset of the commands available in VIDPOP.COM, SAYWHAT'S resident language enhancer. ezTouch can be used in place of VIDPOP whenever using SAYWHAT?! screens (although ezTouch and VIDPOP should not be resident at the same time).

SYSTEM REQUIREMENTS

- ezTouch runs on the PC-DOS® and MS-DOS® operating systems installed on IBM PC family and PC compatible computers. What you specifically need is:
- IBM PC/XT/AT, Hewlett-Packard VECTRA[®], COMPAQ[®] or compatible computer
- 256K bytes minimum memory. ezTouch requires approximately 73K of RAM on systems with a color card (CGA or EGA) and 85K of RAM on systems with a monochrome card

ezTouch COMMANDS

ARE YOU THERE

CLEAR

DEFINE TARGETS

DIAGNOSTICS

DISPLAY PAGE n

DO CALIBRATION

EMPTY

FILL PAGE n

MOVE LINES

PRINT SCREEN

RESET

SET BEEP < ON/OFF>

SET BLINK < ON/OFF>

SET CARET < ON/OFF>

SET CARRIAGE RETURN < ON/OFF>

SET COM PORT TO [<n>]

SET DIAGNOSTIC TIMEOUT TO <n>

SET FLASH TO <duration>

SET FLASH < ON/OFF>

SET KEYBOARD < ON/OFF>

SET MESSAGE < ON/OFF>

SET MODE TO CONTINUOUS

SET MODE TO ENTRY POINT SET MODE TO EXIT POINT

SET MODE TO INTERRUPT

SET MODE TO ON EXIT

SET MODE TO TRACKING

SET TARGETS TO <filename>

SET XY TO <coordinate system>

SWAP XY

TERMINATE

TOUCH SCREEN <screen number>, <timeout>

The following commands allows SAYWHAT?! screens to be displayed or stored:

<filename> (to display SAYWHAT?! image file)

FILL PAGE n filename (moves SAYWHAT?! file from disk to "pigeon hole".)

- Any compatible monochrome, CGA or EGA video card
- Serial communication port for the Dale TIP touch panel
- PC-DOS or MS-DOS version 2.0 or greater
- · One disk drive
- A Dale Electronics, Inc. TIP infrared touch panel

SAYWHAT?!® Screen Generator Software



SAYWHAT?! is a stand-alone all-in-one tool for computer users that gives them the ability to quickly create fantastic screens for menus, data entry screens, data display and help panels. SAYWHAT?! screens can be displayed by any programming language with just a single line of code. SAYWHAT?! also creates screens just as quickly and easily for use by non-programmers to be displayed directly from the keyboard or through batch file "scripts". Even slide shows are easily prepared with SAYWHAT?!

SAYWHAT?! lets you work with lined and unlined boxes, horizontal and vertical lines, special characters and attributes and of course colors. You quickly create visually balanced and aesthetic screens that are a pleasure to read and work with when they become part of your applications.

SAYWHAT?! lets you visually enter the location of all your dBASE GET statements, (or Turbo ReadLn, or BASIC INPUT statements) and lets you enter variable names and picture clauses. SAYWHAT?! will even come up with variable names if you decide not to specify them. SAYWHAT?! also lets you specify the location of data you want to display rather than input, such as the system date (or other variable).

SAYWHAT?! lets you create pop-up windows of any size anywhere on the screen that your application can overlay on top of other screens to give your programs that state of the art "sidekick" feel.

SAYWHAT?! generates the minimum code segment in any version of dBASE, Turbo Pascal and BASIC that you can include in your application program to bring up gorgeous screens complete with data input statements.

SAYWHAT?! can combine up to 100 screens into a single library file, and you can have as many screen libraries as you like.

SAYWHAT?! lets you make moving bar menus in seconds, and manage them at run time with a single line of code in any language.

SAYWHAT?! IS FAST! You create screens quickly because SAYWHAT's?! feel is easy and natural. Even more impressive the startling speed with which screens appear when called by your application program. Screens typically appear in 0.15 seconds, and as quickly as a single video frame time! Rather than paint from left to right and top to bottom, SAYWHAT?! screens "pop" onto your monitor whenever you want them. In some cases, SAYWHAT?! gives you the opportunity to create dazzling screen animation effects.

SAYWHAT? comes loaded with free utilities so you can IMPORT screens from running programs, install SAYWHAT?! to come up just the way you like, send screens to the printer from an application, "roll" screens from the bottom or top of your monitor and much more.

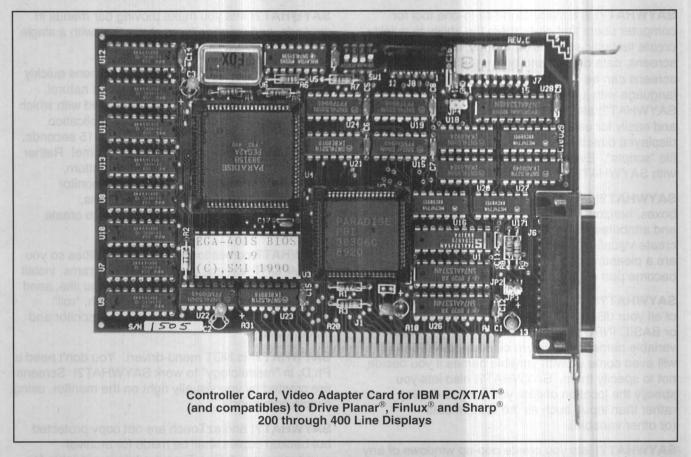
SAYWHAT?! is NOT menu-driven. You don't need a Ph.D. in "menulology" to work SAYWHAT?! Screens are created by you visually right on the monitor, using simple commands.

SAYWHAT?! and ezTouch are not copy protected but backup copies shall be made for archival purposes only. A Run Time module is available for ezTouch under a simple licensing agreement at a nominal price to allow end-users to run ezTouch programs without the obligation of purchasing the complete program.

ezTouch®, SAYWHAT?!®, VIDPOP® are trademarks of Software Science, Inc. MS-DOS® is a trademark of Microsoft. PC-DOS® and IBM PC/XT/AT® are trademarks of IBM. VECTRA® is a trademark of Hewlett Packard. COMPAC® is a trademark of Compaq Computer Corporation.

MODEL PDS-30/1/2 Flat Panel Display Controller EGA/CGA, Controller Card





The PDS-30 video adapter card is a compact 4" x 5" [101.6 x 127.0] XT/AT® half-card which supports all IBM EGA modes and AT&T® mode 40H on 400 line panels. In addition, all CGA modes are supported on 200 line panels. Gray scale circuitry automatically converts RGB color information to gray scale and hatching patterns. This greatly improves the display of existing color software, as well as enhancing the impact of new applications. Two character fonts are active in the 40 and 80 column text modes. The fonts are normal and bold and are selected by the intensity bit of the text attribute.

An external DB-25 connector is provided for use with all panels. Internally, a 16 pin header connector is supplied for connection to the Planar EL8358HR® or Finlux MD640.400-52® EL panel. A 12 pin ZIF connector is provided for internal connection to the Planar EL8358MS. Versions are available for Planar, Finlux and Sharp

Versions are available for Planar, Finlux and Sharp electroluminescent displays. Card for other displays can be obtained by special order.

FEATURES

- IBM/AT/386® Compatible Interface
- Supports all IBM EGA modes on 350/400 line ELD panels
- Supports all IBM CGA modes on 200 line ELD panels
- Converts color software to gray scale and hatching patterns
- · Normal and bold character fonts

ELECTRICAL SPECIFICATIONS

Compatability: IBM XT/AT/386.

Bus: ISA.

Power: 5 VDC @ 1.4A (Card only).

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature: - 40°C to + 100°C.

Operating Temperature: 0°C to + 70°C.

Relative Humidity: 0-90% non-condensing.

This product is available integrated with the display of your choice and with or without a companion infrared touch panel. Dale Electronics, Inc. has a broad line of information display products and manufactures DC Plasma Displays in dot matrix (graphics and character), segmented and bar graph formats (standard and custom). We welcome the opportunity to help you engineer the optimum man-machine interface for your application.

MODEL PDS-30/1/2

Connector Type: D	DB-25S, Female.
Mating Connector:	DB-25P, Male.
PIN	SIGNAL
11 taom tit of t	+12 VDC
20 xitism 6 sh	+5 VDC
3 -012111 201	SMODE1
4	GND
5	VSYNC
6 mon aloun	HSYNC
7 stillion one pr	CLOCK
8	DATA
9 202042	N.C. STUDING
10	N.C.
11	N.C.
12	N.C.
13	N.C.
14	+12 VDC
15	+5 VDC
16	SMODE2
17	GND
18	GND
19	GND
20	GND
21	GND
22	N.C.
23	usa ofusible N.C. and odag joda is
24	N.C.
25	N.C.

J7 - INTERNAL 16 PIN HEADER CONNECTOR

Connector Type: T&B Ansley 609-1627 or equivalent.

Mating Connector: T&B Ansley 609-1630 or equivalent.

PIN	SIGNAL	PIN	SIGNAL	
bina 91T	+12 VDC	2	+12 VDC	
3	+5 VDC	4	+5 VDC	
5	SMODE1	6	SMODE2	
7	GND	8	GND	N.
9	VSYNC	10	GND	
110lbem	HSYNC	12	GND	
13	CLOCK	14	GND	
15	DATA	16	GND	To the second

J8 - INTERNAL 12 PIN ZIF CONNECTORS

Connector Type: Burndy SLEM12R-2 or equivalent. Mating Connector: Gore BMS-829-1-12-X or equivalent.

PIN	SIGNAL	PIN
1	DATASEL	7
2	VIDPOL	8
3	VCLKPOL	9
4	GND	10
5	CLOCK	11
6	GND	12

PIN	SIGNAL
7	DATA
8	GND
9	N.C.
10	GND
11	HSYNC
12	VSYNC

JP4-12 VDC CONNECTOR FOR EXTERNAL POWER

Connector Type: .250" [6.35] square pins on .100" [2.54] centers.

PIN	SIGNAL	41000 Black 1262 Bl
1	+12 VDC	e de Latinización Latinización de desirios
2	GND	

COMPATIBLE D	ISPLAYS
PLANAR	EL8348HR
(bened	EL8358MS
FINLUX	MD640.400-52
SHARP	LJ640U27

CONFIGURATION		1111		7771	Total Caracacacacacaca
JP2 - Panel Select ON = 350/400 Line Panel OFF = 200 Line Panel	SW1 - E0 1 ON	2 OFF	3 OFF	4 ON	EGA Modes Enabled
JP3 - Gray Scale Enable ON = Gray Scale Disabled OFF = Gray Scale Enabled	ON	ON	ON	OFF	CGA Modes Enabled

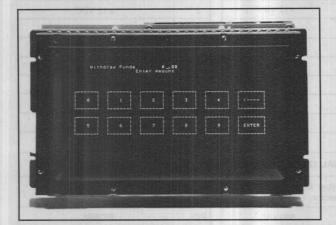
ORDERING INFORMATION

DESCRIPTION	PART NUMBER
Adapter Card for Planar 200, 350, 400 Line ELD Panels	PDS-30
Adapter Card for Finlux 400 Line ELD Panels	PDS-31
Adapter Card for Sharp 400 Line ELD Panels	PDS-32

MODEL TIP Infrared Touch Panels

With Controller





FEATURES

- Fast response time
- Flexible operating modes
- User transparent
- Rugged construction
- · Sealed for environmental resistance
- · Immune to high or changing ambient light
- RS-232C interface
- Pre-assembled no assembly or disassembly required to mount display

TIP products are infrared touch panels designed to fit most flat panel display technologies. The touch panels are a matrix of infrared diodes and detectors, scanning electronics, microprocessor controller, bezel/optical filter assembly and hardware to mount the touch panel and controller to the flat panel display. These touch panels are ideal for many applications including medical instrumentation, machine or process controls, point of sale devices, public information displays, banking and military.

Optional PC based ezTouch® software provides simple touch panel integration, facilitating the creation of user keypads. ezTouch is a resident program and is language independent. Commands are executed by writing to the screen and touch information is read from the keyboard buffer.

ezTouch is a trademark of Software Science, Inc.

ELECTRICAL SPECIFICATIONS

Voltage: $+ 12 \text{ VDC} \pm 5\%$. Current: 400 mA typical.

ENVIRONMENTAL SPECIFICATIONS

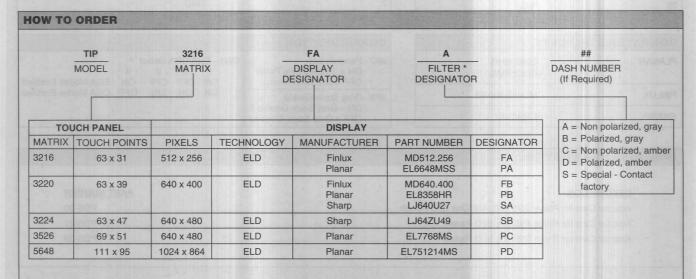
Operating Temperature: 0°C to + 55°C. Storage Temperature: -55°C to + 85°C. Relative Humidity: 10-90% non-condensing.

INTERFACE SPECIFICATIONS

Type: RS-232C.

Data Rate: 300, 1200, 9600 baud and auto baud.

Word Format: 8 bits, no parity, 1 start bit, 1 stop bit.



NOTE: Contact factory for other touch panel and display combinations.

Filters A-D are plastic. Glass filters may be available on selected models.

Other user specified filters will be designated as "S". Contact factory for availability. Any "S" filter designation will require a factory assigned dash number suffix.

MODEL TIP

GENERAL DESCRIPTION

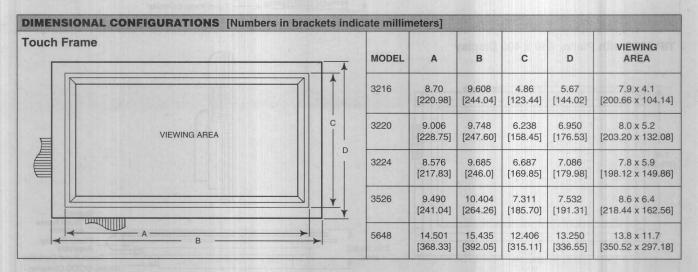
Each Dale® touch panel has infrared LED emitters and detectors along the X— and Y— axis, forming a grid of infrared light beams across the face of the display. The first two numbers of the TIP "matrix" number specify the number of vertical beams and the last two numbers specify the number of horizontal beams. The controller scans the emitter/detector pairs one at a time and determines whether both X and Y beams are blocked, indicating that a finger or stylus is present. (When beams are blocked on only one axis, they are ignored and not reported to the host.) The controller determines the coordinates of the touch point and reports them to the host computer. By interpolating a "virtual" beam between two physical beams, the number of touch points on each axis is effectively doubled. When an odd number of beams along either axis is blocked, the coordinate of the center physical beam is reported. When an even number of beams is blocked, the coordinate of the virtual beam in the center of the blocked beams is calculated and reported. The touch controller supports ENTER, EXIT, CONTINUOUS and TRACKING report modes or combinations of these modes. The controller also has a beeper output. Hardware handshaking, software handshaking, baud rates and auto-baud features are jumper selected. The user initializes the desired report modes and requests reports when needed.

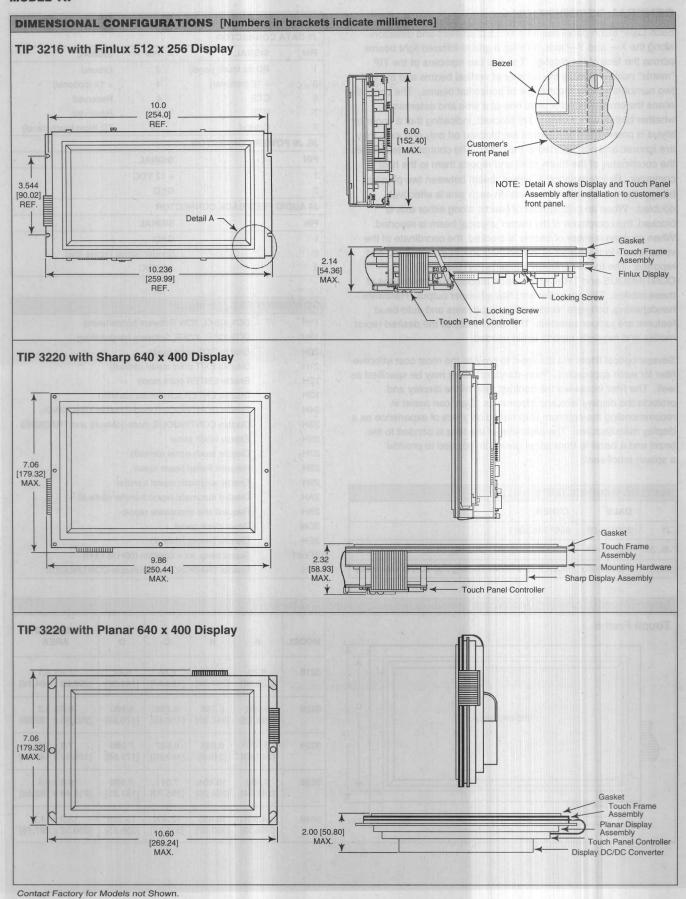
Several optical filters are standard to provide the most cost effective filter for each application. "Non-standard" filters may be specified as well. The filter increases the contrast ratio of the display and protects the display face and electronics. Dale can assist in recommending the optimum filter based on years of experience as a display manufacturer. The perimeter of the filter is bonded to the bezel and a bezel to front panel gasket is included to provide a splash proof seal.

MATI	NG CONNE	MATING CONNECTORS								
	DALE	OTHER								
J1	280105-02	AMP 746288-1								
J5, J6	280108-07	MOLEX 22-01-3027 housing, 08-50-0114 terminals								
J4	280108-06	MOLEX 22-01-3037 housing , 08-50-0114 terminals								

PIN D	ESCRIPTION		
J1 DAT	A CONNECTOR		
PIN	SIGNAL	PIN	SIGNAL
1	RD (to touch panel)	2	Ground
3	+ 12 (optional)	4	+ 12 (optional)
5	CTS	6	Reserved
7	RTS	8	Reserved
9	Ground	10	TD (from touch panel)
J5, J6 I	POWER CONNECTOR		
PIN		SIGNAL	
1		+ 12 VDC	
2		GND	
J4 AUE	DIO FEED BACK CONNE	CTOR	
PIN		SIGNAL	
1	ALVASIA	GND	
2		Beeper Si	gnal (active low)
3		+ 5 VDC	

COMMA	ND SET (Abridged)
11H	DC1, Ctl Q, XON Software handshaking
13H	DC3, Ctl S, XOFF, Software handshaking
20H	Enable EXIT point mode
21H	Disable EXIT point mode (default)
22H	Enable ENTER point mode
23H	Disable ENTER point mode (default)
24H	Enable CONTINUOUS mode/disable TRACKING
25H	Disable CONTINUOUS mode (default) and TRACKING
26H	Enable touch panel
27H	Disable touch panel (default)
28H	Request Failed beam report
29H	Enable automatic report transfer
2AH	Disable automatic report transfer (default)
2BH	Request one coordinate report
2CH	Reset touch panel
2EH	Disable beeper (default)
2FxxH	Sound beep, xx = duration (00H to FFH)
34H	Enable TRACKING mode/disable CONTINUOUS

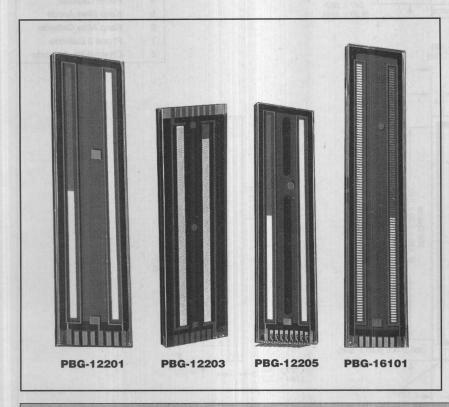




MODEL PBG Plasma Panel Displays

Dual Linear Bar Graph





FEATURES

- Two separate bar graphs, each including reset for 1/2% or 1% resolution (see chart)
- At normal viewing distances glow blends into continuous, but precisely controlled bar length
- Unique scanning technique minimizes the number of drivers required
- PBG-12203 bars may be scanned from either direction or both both directions simultaneously
- PBG-12203 can display four separate columns of information, providing combined total of information does not exceed 201 clock counts per bar

ENVIRONMENTAL SPECIFICATIONS

Altitude: 0 to 70,000 feet.

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C. Relative Humidity (No Condensation):

85% maximum.

Vibration: .018 inches DA, 10 to 50 Hz,

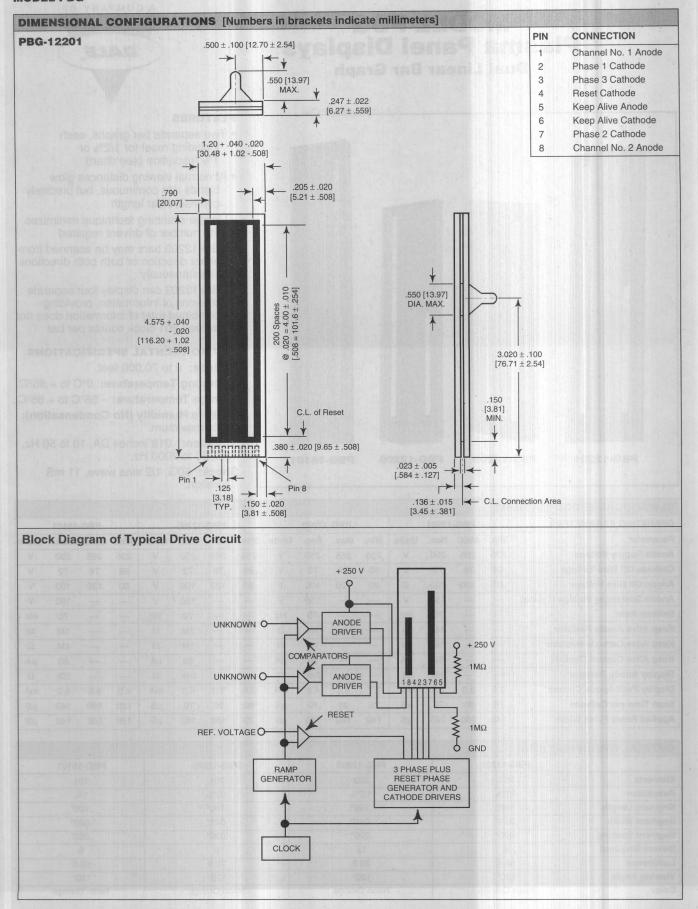
2G, 50 to 2000 Hz.

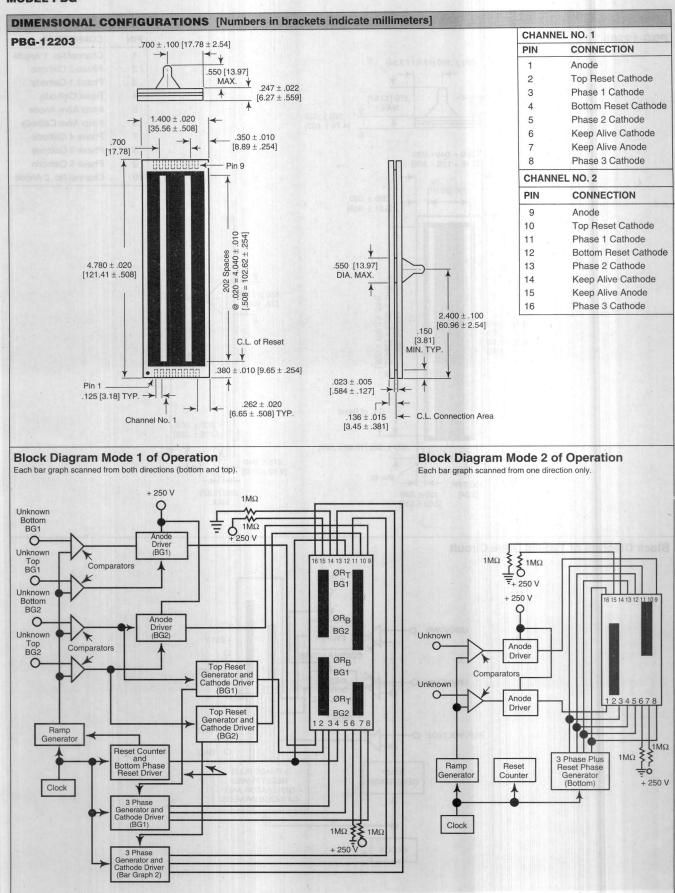
Shock: 50G, 1/2 sine wave, 11 mS

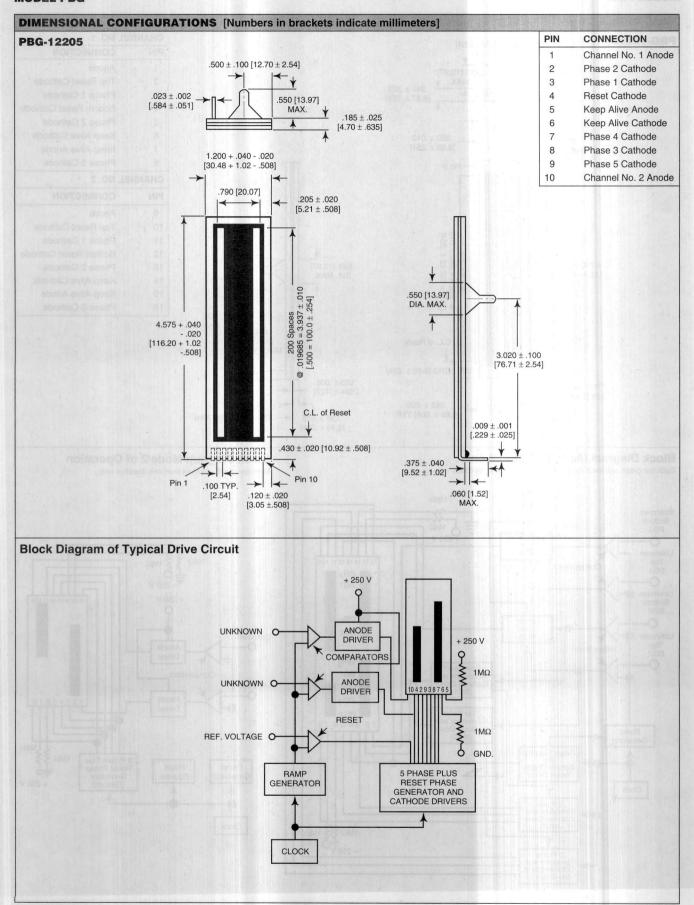
duration.

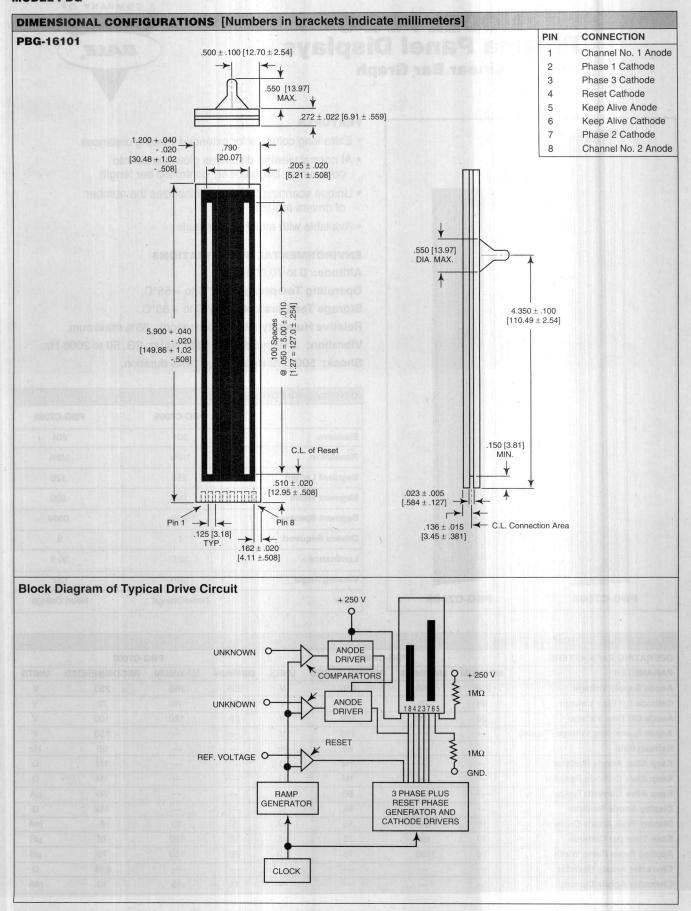
ELECTRICAL SPECIFICATIO	ONS															
OPERATING PARAMETERS		PBG-12201			PBG-12203			PBG-12205				PBG-16101				
Parameter	Min.	Max.	Rec.	Units	Min.	Max.	Řec.	Units	Min.	Max.	Rec.	Units	Min.	Max.	Rec.	Units
Anode Supply Voltage	235	265	250	V -	235	265	250	V	235	265	250	V	235	265	250	V
Cathode Off Bias Voltage	68	76	72	V	68	76	72	V	68	76	72	V	68	76	72	V
Anode Off Bias Voltage	80	120	100	V	80	120	100	V	80	120	100	V	80	120	100	V
Anode Sustaining Voltage (Typical)	_	1-1	150	V		-	150	V		-	150	V		-	150	٧
Refresh Rate	_	_	70	Hz	-	_	70	Hz	_	_	70	Hz	_	-	70	Hz
Keep Alive Anode Resistor	-		1M	Ω	-	-	1M	Ω	-		1M	Ω	_	-	1M	Ω
Keep Alive Cathode Resistor	-	-	1M	Ω	-	-	1M	Ω	_	-	1M	Ω	_	_	1M	Ω
Keep Alive Current (Typical)	-	1-1	50	μΑ	-	120	50	μΑ	_	-	50	μΑ	_		50	μΑ
Display Anode Resistor	_	-	36k	Ω	_	i -	24k	Ω	D. J ee O	Ol Ho	24k	Ω		_	20k	Ω
Display Peak Anode Current	2.5	3.0	2.8	mA	3.7	4.5	4.2	mA	3.5	5.0	4.0	mA	4.0	6.0	5.0	mA
Scan Time per Cathode	70	90	70	μS	70	90	70	μS	60	90	70	μS	120	180	140	μS
Applied Reset Pulse Width	140	180	140	μS	140	180	140	μS	70	180	140	μS	120	180	140	μS

OPTICAL SPECIFIC	CATIONS			
	PBG-12201	PBG-12203	PBG-12205	PBG-16101
Elements	201	203	201	101
Resolution	1/2%	1/2%	1/2%	1%
Segment Length	.100"	.150"	.100"	.100"
Segment Width	.011"	.010"	.011"	.020"
Segment Spacing	.020"	.020"	.020"	.050"
Drivers Required	6	12	8	6
Luminance	35 fl	30 fl	70 fl	60 fl
Viewing Angle	120°	120°	120°	120°
Color	Neon Orange	Neon Orange	Neon Orange	Neon Orange





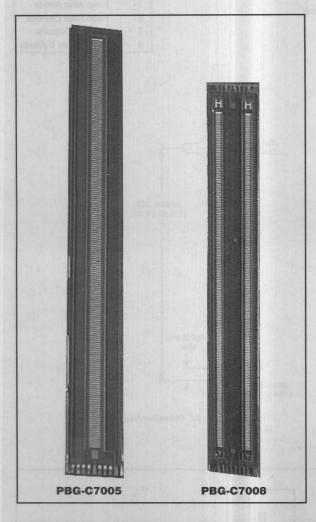




MODEL PBG-C Plasma Panel Displays

Linear Bar Graph





FEATURES

- Extra long columns for extended viewing distances
- At normal viewing distances glow blends into continuous, but precisely controlled bar length
- Unique scanning technique minimizes the number of drivers required
- · Available with attached terminals

ENVIRONMENTAL SPECIFICATIONS

Altitude: 0 to 70,000 feet.

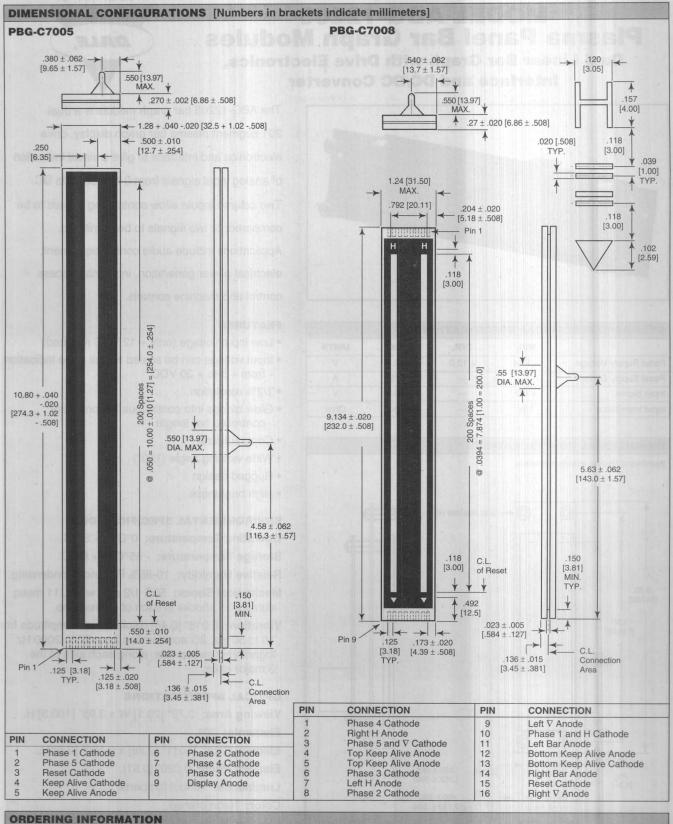
Operating Temperature: 0° C to + 55° C. Storage Temperature: - 55° C to + 85° C.

Relative Humidity (No condensation): 85% maximum. Vibration: .018 inches DA, 10 to 50 Hz, 2G, 50 to 2000 Hz.

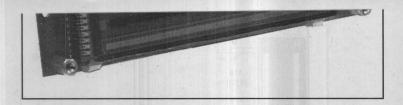
Shock: 50G, 1/2 sine wave, 11 mS duration.

OPTICAL SPECIFICA	ATIONS	对于 国际公司
	PBG-C7005	PBG-C7008
Elements	201	201
Resolution	1/2%	1/2%
Segment Length	.250	.120
Segment Width	.020	.020
Segment Spacing	.050	.0394
Drivers Required	7	8
Luminance	30 fl	30 fl
Viewing Angle	120°	120°
Color	Neon Orange	Neon Orange

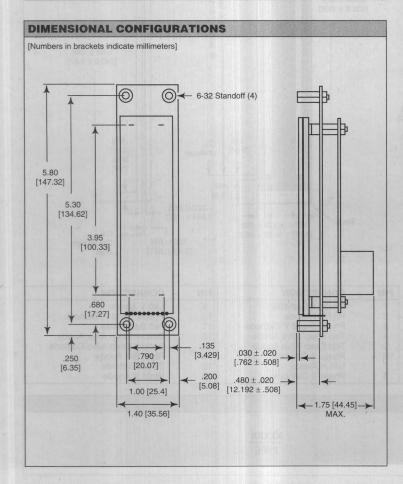
ELECTRICAL SPECIFICATIO	NS							
OPERATING PARAMETERS	12/3	PB	G-C7005		1000 UP 2110 L	PBO	G-C7008	
PARAMETER	MINIMUM	MAXIMUM	RECOMMENDED	UNITS	MINIMUM	MAXIMUM	RECOMMENDED	UNITS
Anode Supply Voltage	235	265	250	٧	235	265	250	V
Cathode Off Bias Voltage	68	76	72	V	68	76	72	V
Anode Off Bias Voltage	80	120	100	V	80	120	100	V
Anode Sustaining Voltage (Typical)	-		150	V	- 15		150	V
Refresh Rate	- 3		66	Hz		_	65	Hz
Keep Alive Anode Resistor	- 3		1M	Ω	_	_	1M	Ω
Keep Alive Cathode Resistor			1M	Ω		-	1M	Ω
Keep Alive Current (Typical)	- 11	BUS -	50	μΑ	_88		50	μΑ
Display Anode Resistor			6k	Ω	- 10		15k	Ω
Display Peak Anode Current	10	20	15	mA	6	10	8	mA
Scan Time per Cathode	70	150	75	μS	70	150	75	μS
Applied Reset Pulse Width	70	150	75	μS	70	150	75	μS
Character Anode Resistor	-	<u> </u>		NO L S	- 12		6.8k	Ω
Character Anode Current	-			_	11	15	13	mA



ORDERING INFORMATION			
	PBG	xxxxx	
	PBG MODEL	XXXXX TYPE	



STANDARD ELECT	TRICAL SPE	CIFICATIO	NS	
	MIN.	TYP.	MAX.	UNITS
Panel Supply Voltage	+ 11.4	+ 12.0	+ 12.6	٧
Panel Supply Current	The state of the s		0.75	А
Input Signal	+ 5.0		+ 30.0	У
Input Impedance	10k		60k	Ohm



compared, or two signals to be monitored.

Applications include audio control equipment, electrical power generation, industrial process control and machine controls.

FEATURES

- Low input voltage (only + 12 VDC required)
- Input voltage can be scaled for full scale indication from + 5 to + 30 VDC
- 1/2% resolution
- Glow blends into continuous but precisely controlled bar length
- Compact size
- Wide viewing angle (150°)
- Rugged design
- High brightness

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: 0°C to + 55°C. Storage Temperature: - 55°C to + 85°C.

Relative Humidity: 10-85% R.H. non-condensing.

Mechanical Shock: 50G 1/2 sine wave, 11 msec duration, 5 shocks in each of 6 directions.

Vibration: 0.018" [0.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

OPTICAL SPECIFICATIONS

Viewing Area: 0.79" [20.1] W x 3.95" [100.3] H.

Elements: 201.

Element Size: 0.011" [0.28] x 0.100" [2.54] L.

Element Pitch: 0.020" [0.51]. Luminance: 70 foot lamberts.

Color: Neon orange.

Viewing Angle: 150° cone. Refresh Frequency: 70 Hz.

MODEL ABG-12205

GENERAL DESCRIPTION

The ABG-12205 consists of a 5 phase dual linear plasma bar graph display, driver circuitry and an interface circuit. A DC/DC converter is also included to develop the necessary panel voltage.

The display operates on the patented principle known as "glow transfer". The display has 201 cathode elements per column, of which the first element in each column is a "reset" cathode. The remaining cathodes are connected in 5 phases where every 5th cathode is connected. The columns are scanned from the bottom to top by pulsing the reset cathode low, followed by sequentially pulsing each phase low until the top cathode is reached, at which time a new scan is started at the reset cathode. The anodes are energized starting at the time the reset cathode is energized until the desired display height is reached, at which time the anode is turned off for the balance of the scan time. The cathodes are refreshed at a 70 Hz rate so the scan appears to be flicker free.

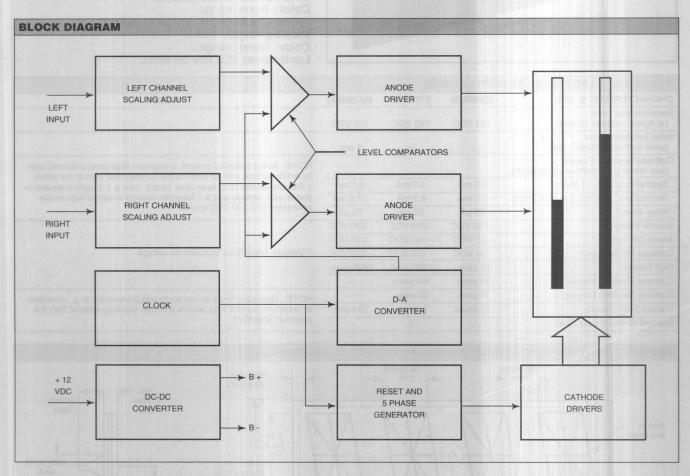
The interface circuit uses a voltage ramp, derived from a D-A converter driven by a clock oscillator and level comparators to control the anode drivers. The unknown (input) signal is applied to one input of the comparator and the voltage ramp applied to the other input. When the ramp voltage coincides with the unknown

signal, the anode driver is turned off, stopping the illumination of the bar graph column at that point on the scan.

The scaling adjustments are made by applying the maximum DC voltage to be measured (up to 30 volts) to the inputs and adjusting the right and left column trimmer resistors so that the columns are illuminated to full scale. (The adjustments are factory set for a 5 volt full scale reading.)

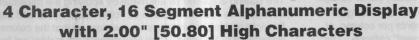
A common return is provided for each input and should be used to minimize noise that could cause the signal on the column to jitter.

PIN DESCRIPTIO	ON
PIN	SIGNAL
1	RIGHT COLUMN INPUT SIGNAL
2	RIGHT COLUMN INPUT GROUND
3	LEFT COLUMN INPUT SIGNAL
4	LEFT COLUMN INPUT GROUND
5	+ 12 VDC
6	GROUND

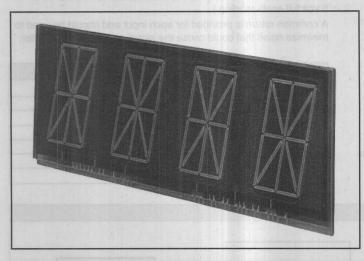


DESCRIPTION	PART NUMBER
Display and Drive Electronics	ABG-12205
Mating Connector Kit	280108-06
Non-Glare Filter (amber circular polarized) - other filters available, contact factory	280109-07

MODEL PD-04A200 Plasma Panel Displays







FEATURES

- 200 foot lamberts brightness
- Designed for multiplexed operation
- Edgeboard connection
- (terminals available as PD-04A200-2)
- End stackable

MAXIMUM RATINGS *

Peak Applied Voltage: 250 volts.

Operating Temperature: 0°C to + 55°C.

Storage Temperature: - 55°C to + 85°C.

Altitude: 70,000 feet.

* Values beyond which the life of the device may be reduced.

OPTICAL SPECIFICATIONS

Color: Neon orange

(Filterable from red, orange to yellow).

Viewing Angle: 130°. Color: Neon orange.

Luminance: 200 foot lamberts.

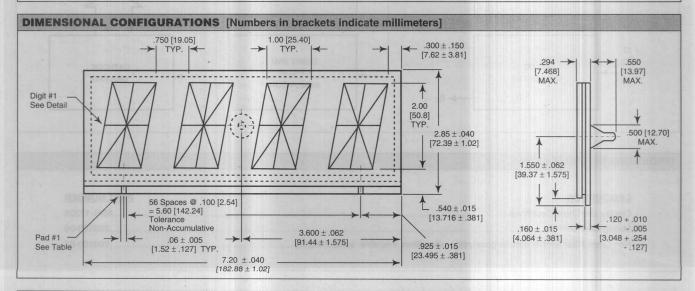
STANDARD ELECTRICAL SPE	CIFICATIO	NS	
CHARACTERISTIC @ 25°C	MINIMUM	TYPICAL	MAXIMUM
Panel Voltage Drop (at typical cathode current)	130 VDC	145 VDC	170 VDC
Initial Ionization Time (peak cathode voltage - 180)	_	TAGE GARAGE	5 sec.
Cathode Segment Current (see drawing for cathode designation)			
Segments a, b, p, I, f and e	2.5 mA	4.3 mA	8.7 mA
Segments c, d, g, h, i, j, k, m, n and o	5.0 mA	8.6 mA	17.5 mA
Keep Alive †	25 μΑ	50 μΑ	75 μΑ
Source Voltage *	- 180 VDC	- 200 VDC	- 220 VDC
Anode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC
Cathode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC
Digit Period	80 μsec.	1250 µsec.	2500 μsec.
Cathode Blanking Interval	20 μsec.	100 μsec.	
Cathode Blanking Overlap	10 μsec.	50 μsec.	
Display Scan Period	.32 msec.	5 msec.	10 msec.
Number of Anodes per Scan	9 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4	

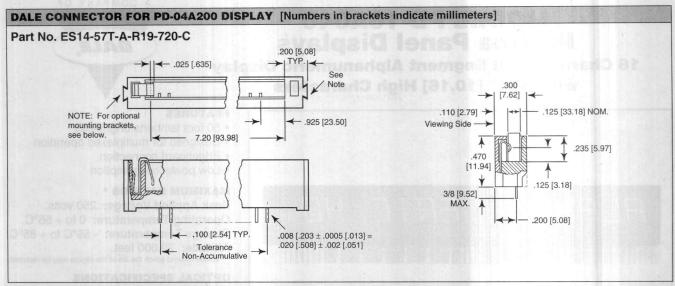
NOTE: At the specified current, a segment shall glow uniformly over its entire surface with no glow visible on any other part of the panel. † Recommended D.C. keep alive circuit: Use a 1 Megohm resistor in series with cathode and a 1 Megohm resistor in series with anode connected to a 200 VDC source.

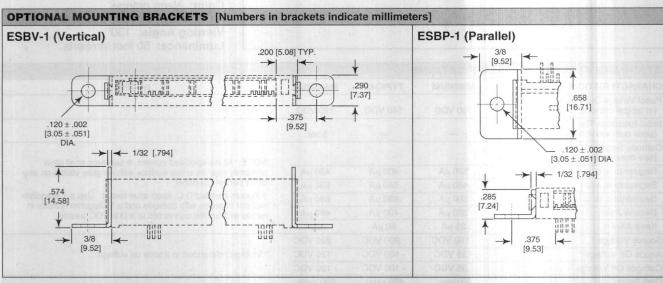
NOTES

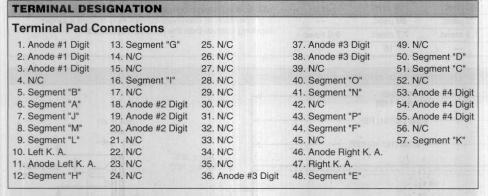
* Voltage referenced to anode on voltage.

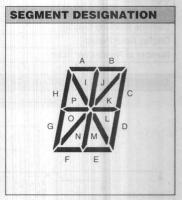
NOTE: Operating limits do not apply simultaneously, e. g., operation at maximum current may require a longer blanking interval than the minimum specified.



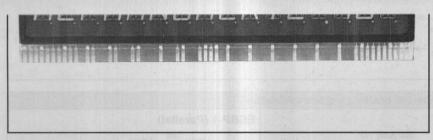








Display with Edgeboard Type Connection	PD-04A200
Display with Attached Terminals (Solderable)	PD-04A200-2



Operating Temperature: 0 to + 55°C. **Storage Temperature:** - 55°C to + 85°C.

Altitude: 70,000 feet.

* Values beyond which the life of the device may be reduced.

OPTICAL SPECIFICATIONS

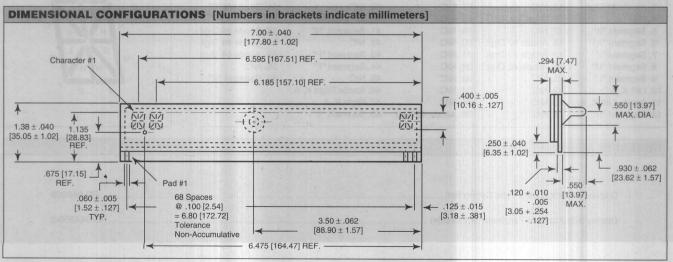
Color: Neon orange

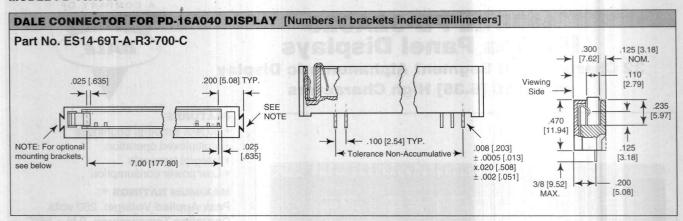
(Filterable from red, orange to yellow).

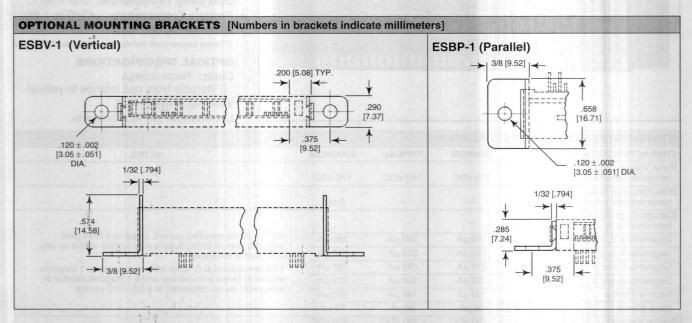
Viewing Angle: 130°.

Luminance: 50 foot lamberts.

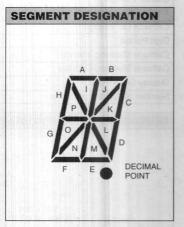
OUADAOTEDICTIO & OF O	A ALL UNAL INA	TYPICAL	NA A VINALINA	NOTES
CHARACTERISTIC @ 25°C	MINIMUM	TYPICAL	MAXIMUM	NOTES
Panel Voltage Drop (at typical cathode current)	130 VDC	145 VDC	170 VDC	
Initial Ionization Time (peak cathode voltage - 180)			5 sec.	
Cathode Segment Current (see drawing for cathode designation)				NOTE: At the specified current, a segment shall glow
Segments a, b, p, I, f and e	320 μΑ	400 μΑ	480 μΑ	uniformly over its entire surface with no glow visible on any
Segments m and i	480 μΑ	540 μΑ	630 μΑ	other part of the panel.
Segments c, d, g, h, j, k, n and o	560 μΑ	630 μΑ	680 μΑ	† Recommended D.C. keep alive circuit: Use a 1 Megohm resistor in series with cathode and a 1 Megohm resistor in
Decimal Point	320 μΑ	400 μΑ	480 μΑ	series with anode connected to a 200 VDC source.
Keep Alive †	25 μΑ	50 μΑ	75 μΑ	
Source Voltage *	- 180 VDC	- 200 VDC	- 220 VDC	
Anode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC	* Voltage referenced to anode on voltage.
Cathode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC	
Digit Period	80 μsec.	480 μsec.	600 μsec.	
Cathode Blanking Interval	40 μsec.	100 μsec.		NOTE: Operating limits do not apply simultaneously,
Cathode Blanking Overlap	20 μsec.	50 μsec.		e.g. operation at maximum current may require a longer
Display Scan Period	1.3 msec.	7.7 msec.	9.6 msec.	blanking interval than the minimum specified.
Number of Anodes per Scan		16	JEST BELIEF TE	





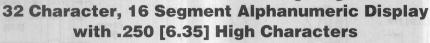


Terminal Pad C	Connections			
1. Anode, K.A.	15. N/C	29. Anode #7 Digit	43. N/C	57. Anode #14 Digit
2. Segment "C"	16. Anode #4 Digit	30. N/C	44. N/C	58. N/C
3. K.A.	17. Segment "E"	31. N/C	45. Anode #11 Digit	59. N/C
4. Anode #1 Digit	18. N/C	32. Segment "M"	46. N/C	60. Segment "O"
5. Segment "H"	19. N/C	33. Anode #8 Digit	47. N/C	61. Anode #15 Digi
6. Segment "B"	20. Decimal	34. K.A.	48. N/C	62. Segment "L"
7. Segment "A"	21. Anode #5 Digit	35. Anode K.A.	49. Anode #12 Digit	63. Segment "P"
8. Anode #2 Digit	22. N/C	36. N/C	50. N/C	64. Segment "K"
9. Segment "G"	23. N/C	37. Anode #9 Digit	51. N/C	65. Segment "I"
10. Segment "D"	24. N/C	38. N/C	52. N/C	66. Anode #16 Digi
11. N/C	25. Anode #6 Digit	39. N/C	54. Anode #13 Digit	67. K.A.
12. Anode #3 Digit	26. N/C	40. N/C	54. N/C	68. Anode K.A.
13. Segment "F"	27. N/C	41. Anode #10 Digit	55. N/C	69. Segment "J"
14. N/C	28. Segment "N"	42. N/C	56. N/C	

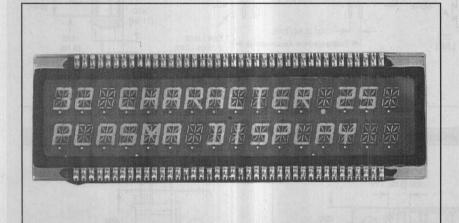


RDERING INFORMATION 1 4.	
Display with Edgeboard Type Connection	PD-16A040

MODEL PD-32A025 Plasma Panel Displays







FEATURES

- 80 foot lamberts brightness
- Multiplexed operation
- Integral terminals
- Low power consumption

MAXIMUM RATINGS *

Peak Applied Voltage: 250 volts.

Operating Temperature: 0 to + 55°C.

Storage Temperature: - 55°C to + 85°.

Altitude: 70,000 feet.

* Values beyond which the life of the device may be reduced.

OPTICAL SPECIFICATIONS

Color: Neon orange

(Filterable from red, orange to yellow).

Viewing Angle: 130°.

Luminance: 80 foot lamberts.

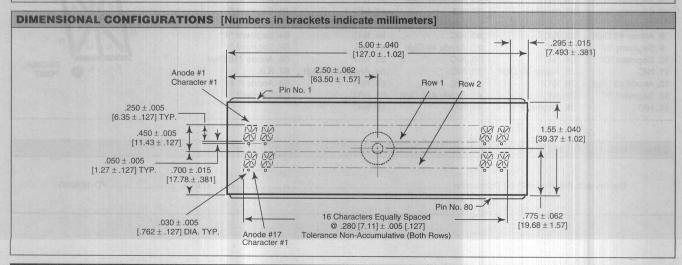
NOTES

STANDARD ELECTRICAL SPE	CIFICATIO	VS	
CHARACTERISTIC @ 25°C	MINIMUM	TYPICAL	MAXIMUM
Panel Voltage Drop (at typical cathode current)	130 VDC	145 VDC	170 VDC
Initial Ionization Time (peak cathode voltage - 180)			5 sec.
Cathode Segment Current (see drawing for cathode designation)			
Segments a, d, f, j, n and t	180 μΑ	230 μΑ	280 μΑ
Segments b, c, g, h, I and r	270 μΑ	350 μΑ	430 μΑ
Segments k and p	210 μΑ	280 μΑ	350 μΑ
Segments m and s	225 μΑ	300 μΑ	375 μΑ
Decimal Point e	135 μΑ	180 μΑ	225 μΑ
Keep Alive †	25 μΑ	50 μΑ	75 μΑ
Source Voltage *	- 180 VDC	- 200 VDC	- 220 VDC
Anode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC
Cathode Off Voltage *	- 35 VDC	- 100 VDC	- 120 VDC
Digit Period	80 μsec.	480 μsec.	600 μsec.
Cathode Blanking Interval	20 μsec. ·	100 μsec.	
Cathode Blanking Overlap	10 μsec.	50 μsec.	
Display Scan Period	1.3 μsec.	7.7 msec.	9.6 msec.
Number of Anodes per Scan		16	

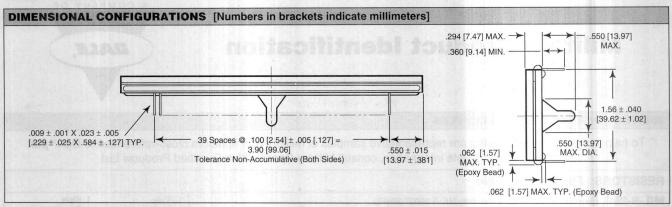
NOTE: At the specified current, a segment shall glow uniformly over its entire surface with no glow visible on any other part of the panel.

† Recommended D.C. keep alive circuit: Use a 1 Megohm resistor in series with cathode and a 1 Megohm resistor in series with anode connected to a 200 VDC source.

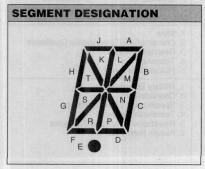
NOTE: Operating limits do not apply simultaneously, e.g. operation at maximum current may require a longer blanking interval than the minimum specified.



^{*} Voltage referenced to anode on voltage.



TERMINAL DE	SIGNATION	V Comment					
Terminal Pad (Connection	S		HE THE OWNER ADSW			
TERMINATING PAD NO.	ROW NO.	SEGMENT	ANODE POSITION	TERMINATING PAD NO.	ROW NO.	SEGMENT	ANODE POSITIO
Maio Ances automates	1		1	41 00-40	2	- 10 MH	17
2	Wallet and	D		42	2	Н	
3	1		2	43	2		18
4	1	E		44	2	В	
5	1		3	45	2	_ 1038	19
6	and 1 benefit	F F		46	2	Α	Richard -
7	1	J		47	2	- 1711	20
8	1		4	48	2	J	
9	- solut const	N/C		49	2		Left K.A
10	1 2000	Н		50	2	L	
11	1		5	51	2	- 1.74	21
12	1	unit L	AL INC. THE RESERVE SERVE	52	2	Left K.A.	
13	1	ment E. L. Conne	6	53	2	_	22
14	1	Α		54	2	E	
15	1	M		55	2	N/C	in Social Communication
16	1 00 00	10.00 S. 1 - 10.00 MINUST	7	56	2		23
17	be and passing	N/C	All too he in the	57	2	R	
18	DE STE PUBLISHED	K		58	2	N/C	
19	1	alabor	8	59	2		24
20	1 lens	N		60	2	S	
21	Tracky socia	N/C		61	2		25
22	1	BOUGH NEW YORK	9	62	2	N/C	_
23	1	T		63	2	C	
24	1 9000	N/C		64	2	_	26
25	61 W Y 6018A		10	65	2	D	_
26	The second second	Р		66	2	G	
27	1	styre III	11	67	2		27
28	4	N/C		68	2	F	_
29	1	R		69	2		28
30	Table 1		12	70	2	Right K.A.	20
31	1	N/C	12	71	2	Hight N.A.	Right K.
32	1	В		72	2	Р	night K./
33	1	_	13	73	2		29
34	1	S		74	2	T	29
35	1	N/C		75	2		30
36	1 control	- IV/C	14	76	2	N	30
37	1		14	76	2	K	
38	1		15	78		<u> </u>	- 01
39	1	G	15	78	2		31
40	1				2	M	_
40			16	80	2		32



ORDERING INFORMATION	
Display with Integral Connector Pins	PD-32A025

Military Product Identification



MILITARY PART ORDERING EXAMPLES

To help in ordering, the following are representative samples of military part numbers cross-referenced to Dale® part numbers. For complete information, consult Military Specification Qualified Products List.

numbers. For complete information, consult Military		
RESISTORS: Fixed and Variable		
RW80 U 49R9 F = Dale Type G-3 49.9 ohm 1% RW69 V 101 = Dale Type CW-2C-1 100 ohm, 5% T 2 3 = Dale Type CW-2C-1 100 ohm, 5%		1. Style 2. Characteristic 3. Resistance Value 4. Tolerance 1. Style 2. Characteristic 3. Value (Tolerance below 1 ohm 10% 1 ohm and up 5%)
MIL-R-10509F (Basic [RN]) (Established Reliability MIL-R-55182 [RNR]) RN60	omeon than	Style Characteristic - Temperature Coefficient Resistance Value Tolerance
MIL-R-18546D (Basic [RE]) (Established Reliability MIL-R-39009 [RER]) RE65 G 1001 = Dale Type RH-10 1k 3	NOTE: 1% tolerance per Military Specification.	Style Characteristic - Maximum continuous operating temperatures Resistance Value
RL07 S 103 J = Dale Type CMF-07 1 10k 5% 1 2 3 4 = Dale Type CMF-07 10k 5%	NOTE: Parts will be color banded.	1. Style 2. Terminal 3. Resistance Value 4. Tolerance
MIL-R-22097F (Basic [RJ]) (Established Reliability MIL-R-39035 [RJR]) RJ24 F P 103 = Techno Type 412 1k 10% 1 1 2 3 4 4 4 1 1	NOTE: 10% tolerance per Military Specification.	1. Style 2. Characteristic 3. Terminal 4. Resistance
RT24 C 2 2 P 4 5% 1 2 3 4 5 5	NOTE: 5% tolerance per Military Specification.	1. Style 4. Terminal 2. Resistance - 5. Resistance Temperature Characteristic 3. Temperature Characteristic
	3 5	1. Style 5. Failure Rate Leve 2. Terminal 3. Resistance Value 4. Tolerance
MIL-R-39009C (Established Reliability [RER]) (Basic - MIL-R-18546 [RE]) RER65 F 1001 R = Dale Type ERH-10 1% 1k R 1 2 3 4 4 1 4 1	00	1. Style 2. Tolerance 3. Resistance Value 4. Failure Rate Level
MIL-R-39015C (Established Reliability [RTR]) (Basic - MIL-R-27208 [RT]) RTR24 D P 102 R = Techno Type M39015/3 007 P R S 1 2 3 4 5 1, 2 4 3 5 NOTE: 5% tolerance per Military Specification.		Style Characteristic Terminal Resistance Failure Rate Level
MIL-R-39017E (Established Reliability [RLR]) (Basic - MIL-R-22684 [RL]) RLR07 C 1002 G R = Dale Type ERL-07 10k 2% R 1 2 3 4 5 = Dale Type ERL-07 10k 2% R 5 5 5 5 5 5 5		1. Style 5. Failure Rate Leve 2. Terminal Type 3. Resistance Value 4. Tolerance
MIL-R-39035B (Established Reliability [RJR]) (Basic - MIL-R-22097 [RJ]) RJR24 F P 102 R = Techno Type RJR24 F P 1k 10 NOTE: 10% tolerance per Military Specification. 10% tolerance per Military Specification.)%	Style Characteristic Terminal Resistance Failure Rate Level
M1L-R-49465A (Basic [RLV]) (Established Reliability - None) M49465 1 2 2 3 3 4 5 5 2 - Dale Type CPSL-3-6 0.01 ohm 4 5%	L Ondractoristic.	Military Specification 4. Resistance Value Specification 5. Tolerance Sheet Number 3. Characteristic
MIL-R-55182F (Established Reliability [RNR]) (Basic MIL-R-10509 [RN]) RNC55 H 49R9 F S = Dale Type ERC-55 T-2 49.9 ohm 1 2 3 4 5 1 2 3	1% S 5	Style Characteristic/Temperature Coefficient Resistance Value Tolerance Failure Rate Level
MIL-R-55342E (Established Reliability [RM]) (Basic - None) M55342 M 02 S 100E R = Dale Type RCM550 100k 1% 7 2 3 4 5 6 3,4 5 5 NOTES: M Characteristic. One surface, pretinned, solderable terminations. D55342 is used for 07 detail specification sheet. Separate code for resistance value and tolerance is used in this Military Specification.	> R 6	Military Specification Characteristic Specification Sheet Number Termination Material Resistance Value and Tolerance Failure Rate Level

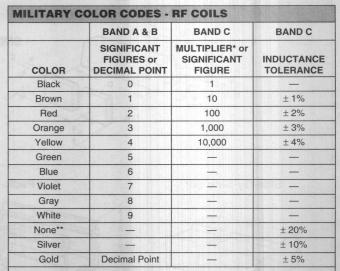
MILITARY PART ORDERING EXAMPLES				
RACK AND PANEL CONNECTORS				
M1L-C-28748A (Basic) (Established Reliability - None) M28748 7 2 8 3 0 4 5 6 7 = Dale Type MMP22G5 7 3	S <u>L2</u> L	Military Specification Specification Sheet No. Insert Designator (B-7 Shield (0 = None)		5. Shell Polarization (0 = None6. Jackscrews or Guidepins7. Contacts (1A = 100 percent size 22)
RESISTOR NETWORKS				
MIL-R-83401F (Basic [RZ]) (Established Reliability MIL-R-874 [RZR]) M8340101 M 1003 G A = Dale Type MDM 100k 2% 1, 2 3 4 5 6 = Dale Type MDM 100k 2%	<u>A</u>	NOTE: M Characteristic.		
Resistance Value Examples Three Digit Figure Four Digit Figure		Fiv	e Digit Figur	re deales
100 = 10 ohm, 101 = 100 ohm 102 = 1k ohm, 203 = 20k ohm 1001 = 1k ohm, 203 = 20k ohm		= 100 ohm	10R60 = 1	0.6 ohm, 10000 = 1k ohm 2.7k ohm, 10202 = 102k ohm
Tolerance Examples				
$A = \pm 0.05\%$ $B = \pm 0.10\%$ $D = \pm 0.50\%$		$F = \pm 1.0\%$	$G = \pm 2.0\%$	$J = \pm 5.0\%$
TRANSFORMERS AND INDUCTORS				
M1L-T-27E (Basic [TF]) (Established Reliability - None) M27 215 05 = Dale Type TE-3Q0TR 1.0 mH 2%	Alpgros	Tiss W. Zard Sinkst. T	3. Specifica	specification tion Sheet Number tion Sheet Dash Number ng Value and Electrical Ratings
MIL-C-15305E (Basic [LT]) (Established Reliability MIL-C-39010) LT 4 K = Dale Type IM-2 (.10 μH to 1.00 μH) 10%		Parts will be color banded. Value per Military Standard dash number.	1. Style 2. Grade an 3. Family K	nd Class = Coil, Radio Frequency, Fixed

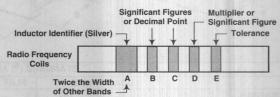
271112	A&B	BAND C			
COLOR	1st and 2nd SIGNIFICANT FIGURE	COLOR	VALUE MULTIPLIEF		
Black	0	Black	1		
Brown	ear. 1	Brown	10		
Red	2	Red	100		
Orange	3	Orange	1,000		
Yellow	4	Yellow	10,000		
Green	5	Green	100,000		
Blue	6	Blue	1,000,000		
Purple (Violet)	7	Silver	0.01		
Gray	8	Gold	0.1		
White	9				
93-	e A B C D E				
First Significant Figu	ire AAAA	Terminal (1 1/2 times wid	th of other bands)		
First Significant Figu Second Signific	ire 1 1 1	Terminal (1 1/2 times wide) Folerance plier			
First Significant Figu Second Signific	ant Figure Multi	Terminal (1 1/2 times wide) Folerance plier	th of other bands)		
First Significant Figu Second Significant BAI	ant Figure Multi	Terminal (1 1/2 times wide Folerance plier	th of other bands)		

8 1/2 x 11 & Pocket-Size Color Code ID Charts

For a 8 1/2 x 11 chart, or a supply of pocket-size charts showing actual colors used in marking film resistors and RF chokes, write to Dale Electronics, Inc., Advertising Department, 2064 12th Avenue, P.O. Box 609, Columbus, NE 68602-0609 or call (402) 563-6417.

Indicate size and type of chart desired: Film Resistor chart or RF Choke.





Band "A" is twice the width of the other bands and is silver in color to identify part as an inductor. ***

For Inductance Values Less Than 10 either Band "B" or Band C" will be gold and will represent the decimal point. The other two bands ("B" and "D" or "C" and "D") will represent significant figures.

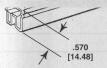
For Inductance Values of 10 or More Band "B" and Band "C" represent significant figures and Band "D" is the Multiplier.

For small units, dots may be used in place of bands.

The multiplier is the factor by which two significant figures are multiplied to yield the nominal inductance value

Indicates body color.

Coated inductors are marked with four color bands, the first being a double wide significant figure or decimal point in lieu of the double wide silver inductor identifier.



Units per Tube

XO-43B, XO-53B, XO-54B, BD, BE: 20 Pieces.

C

.120

[3.05]

.120

[3.05]

D

22 1/4

[565.15]

23 1/2

[596.90]

23 1/2

[596.90]

23 1/2 [596.90]

23 1/2

[596.90]

19

[482.60]

19

[482.60]

19

[482.60]

19

[482.60]

19 7/8

[504.82]

19 7/8

[504.82]

XO-52B, XOSM-52B, BE: 33 Pieces.

DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

RESISTOR NETWORKS [Numbers in brackets indicate millimeters] **END-TO-END TUBE PACK DIMENSIONS** В A SIP DIP 1/2 .600 DIP [12.70] [15.24] SIP .430 .040 SMD Low Profile [10.92][1.02]SIP .605 .040 High Profile [15.37] [1.02] **SURFACE MOUNT NETWORKS** SOGC .400 .150 [10.16] [3.81] SOMC .400 .150 [10.16] [3.81] SIDE-BY-SIDE SIP **10 PIN** .650 1.10 [16.51] [27.94] Flat Pack Side-By-Side SIP 8 PIN .650 .860 [16.51] [21.84] 6 PIN .650 .700 [16.51] [17.78] 4 PIN .650 .500 [16.51] [12.70]

STANDARD (*) AND OPTIONAL (X) PACKAGING

D

		UAL-IN-	LINE	FLAT	PACKS		3-0)	SINGLE	-IN-LINE		SURFAC	E MOUNT
PACKAGING STYLES	MDM	MDP	RC MOLDED	DFM	DFP	csc	MSM	MSP	RC COATED	RC MOLDED	SOGC	SOMC
End-to-End Magazine (Tube)	•	•	•	•	•	X	•	•		• •	11000	10.0
Poly Bag	and the second			X	X	•	sin@		•			100
Side-by-Side SIP		4 15 to 14		501 Paul			X	X				
Tape and Reel	OB CHI	office to		et tiskt to	efer l					Figure	Х	X

• End-To-End Magazine (Tube) Pack DIP/SIP:

A magazine pack for single-in-line and dual-in-line resistor networks. Quantity per pack dependent on size of units. Maximum tube length is 23 1/2" [596.90]. Width and depth of tube dependent on size of individual resistor network.

Poly Bag

Units are packaged in poly bags and then packed in boxes.

Magazine (Tube) Pack Flat Pack:

FLAT PACK DFP

DFM

All flat packs are packaged in individual protective carriers that are considered as part of all flat pack units. Flat pack units are then packed in magazines (tubes).

1.38

[35.05]

1.38

[35.05]

1.10

[27.94]

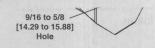
1.10

[27.94]

X Special Packaging:

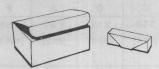
Blister, vial, military, antistatic and customer special packaging can be provided. Consult factory for information.

DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

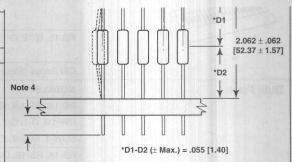


CCF-60, CMF-60,	2500
CMF-20, ERL-20,	
ERC-60, CPF-2	
CMF-65, CPF-3, EBC-65	2000

Bulk Pack

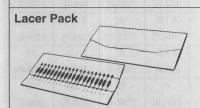


Resistors are uniformly packaged 100 per box with 10 unit boxes per intermediate container.



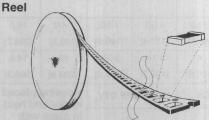
Notes:

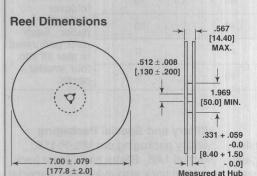
- 1. Quantity per reel: (See table).
- A minimum of 18" [457] bare tape leader shall be provided at each end of the reel.
- 3. Protection between layers of components provided by Kraft paper separator.
- Lead trimming 1/16" [1.59] from tape edge is vailable on request. Standard on CCF-07, CCF-50, CCF-55 and CCF-60.
- Marking of reeled components in 100 piece intervals available on request. Consult factory.



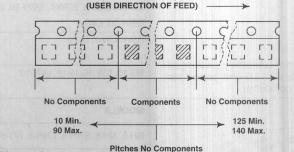
Resistor body placed in slot, held in place with tongue insert. Terminals protected within folder. 20 units per folder.

Tape and Reel Specifications

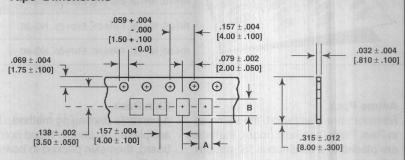




Tape



Tape Dimensions



Marking: All required marking to be on unit package. Individual part marking is available. Stocked, CRCW1206, 5% units are marked with 3 digit value code.

Packaging: Bulk Package = 1000 pieces per plastic bag. 8mm Reel = 5000 pieces per reel per EIA Standard RS-481.

MODEL	A ± .005 [± .130]	B + .005 [± .130]
CRCW0805	.070 [1.78]	.100 [2.54]
CRCW1206	.080 [2.03]	.142 [3.61]
CRCW1210	.115 [2.92]	.142 [3.61]

Packaging Methods





WIREWOUND RESISTORS [Number	rs in drackets indicate millimeters]				ver i mesmesse i e	ent reconstruct	
Lacer Pack	MODELS	Α	В	hander.			
	RS-1/8, RS-1/4, RS-1/2, RS-1A, RS-1B,	8 1/2	3 3/4				
/ A	RS-1M, G-1, G-2, G-3	[215.90]	[95.25]				
11	RS-2, RS-2A, RS-2B, RS-2C,	8 1/2	4	Control of the State of the Sta		placed i	
В	G-5, G-5A, G-5C	[215.90]	[101.60]			with tong	
\$	RS-5, RS-7, G-6, G-10	11	5			20 units	
		[279.40]	[127.00]	folder		20 011110	P 0.
	RS-10, G-12, G-15, DC-2	14 13/16	6 1/16				
	AND SECURITION OF THE SECURITION OF	[376.24]	[153.99]				
	CW Series (Same as RS Series)						
Bulk Pack	MODELS	Α	В	С	D	E	F
	RS-1/8, RS-1/4, RS-1/2, RS-1M, CW-1/2,	\$16 1 2701	1 1	3 5/8	2 1/4	3 3/4	5 3/8
	CW-1M, G-1, G-2, EGS-1, EGN-1,	[25.4]	[25.4]	[92.1]	[57.1]	[95.2]	[136.5]
	EGW-1, EGS-2, EGW-2, MWA-8, MWA-10						
	RS-1A, RS-1B, CW-1, G-3, EGS-3,	1 1/2	1 1/2	3 5/8	5	3 7/8	7 3/4
	EGN-3, EGW-3	[38.1]	[38.1]	[92.1]	[127.0]	[98.4]	[196.8
→ ⊀ A	RS-2, RS-2A, CW-2, CW-2A, G-5A,	3	2 1/4	4 1/8	6	7 1/4	12
****	ESN-2A, ESS-2A, ESW-2A	[76.2]	[57.1]	[104.7]	[152.4]	[184.2]	[304.8]
D	RS-2B, RS-2M, CW-2B, CW-2M, G-5,	2	2	3 7/8	6	7 1/4	12
FI A	ESN-2B, ESS-2B, ESW-2B, LVR-3	[50.8]	[50.8]	[98.4]	[152.4]	[184.2]	[304.8]
F	RS-2C, CW-2C, G-5C	2 5/8	2 1/2	4	6	7 1/4	12
Aldermin assurant energioth it asion at hoo be		[66.8]	[63.5]	[101.6]	[152.4]	[184.2]	[304.8]
	RS-5, RS-5-69, CW-5, CW-5-5, G-10,	3	3 1/2	4 1/4	6	7 1/4	12
	ESN-5, ESS-5, ESW-5, EGN-10, EGS-10,	[76.2]	[88.9]	[107.9]	[152.4]	[184.2]	[304.8
	EGW-10, LVR-5			73			les)
	RS-7, CW-7, G-12	3 7/8	2 1/2	4 5/8	7 1/2	7 1/2	15.5
Axial units are uniformly packaged		[98.4]	[63.5]	[117.4]	[190.5]	[190.5]	[393.7
100 per box with 10 unit boxes per	RS-10, CW-10, G-15, LVR-10	4	4	5 1/4	9 3/4	12	14.5
immediate container.		[101.6]	[101.6]	[133.3]	[247.6]	[304.8]	[368.3]
Card Pack	MODELS	QTY.	PACK	TEAR C	FF QTY.	Housing in slot a	
	RH-5, NH-5, ERH-5, ENH-5, HG-5	4	10	1	10	in place	with
	RH-10, NH-10, ERH-10, ENH-10, HG-10		10	10		protecti paper.	ve
	RH-25, NH-25, ERH-25, ENH-25, HG-25	2	20		5	pack pe	erforate
	RH-50, NH-50, ERH-50, ENH-50, HG-50	2	20		5	four sm	

Ammo Pack

Resistors are lead taped, the same as in Reel Pack (see next page), then they are placed in a continuous "S" pattern (without paper inner leaf) in an appropriate box.

Skin Pack

A versatile packaging method. Units are placed on double-faced corrugated board, then skin packed to board with polyfilm. Most resistor types are in multiples of five with insert strips.

Military and Special Packaging

Military packaging per MIL-P-116, Method 1A8. Blister pack, foam pack and vial pack also available for special requirements.

Packaging Methods





Reel Pack Dale® Standard Packaging Technique Note 3 9/16 to 5/8 [14.29 to 15.88] Hole Lead tape reel packaging of axial lead

Lead tape reel packaging of axial lead components available per EIA RS 296 standard upon request.

Note 1: Component Spacing Standard Options:

Maximum Body Diameter	Spacing
0200 [0 - 5.08]	.200 [5.08]
.201375 [5.11 - 9.52]	.375 [9.52]
.376400 [9.55 - 10.16]	.400 [10.16]

	MAXIMUM UN	ITS PER REEL		
MODELS	SMALL FLANGE "B" 7 1/2 [190.50]		PITCH (Note 1)	TAPE SPACING (Note 2)
RS-1/8, RS-1/4, RS-1/2,	2000	4500	.200	2 7/8
G-1, G-2, CW-1/2			[5.08]	[73.02]
RS-1A, RS-1B, G-3,	1500	4000	.200	27/8
CW-1, CW-1M			[5.08]	[73.02]
CA-1, CA-2 (Note 4)	1350	3000	.200	2 7/8
			[5.08]	[73.02]
RS-2A, RS-2B, RS-2M, CW-2A,	650	1200	.375	2 7/8
CW-2B, CW-2M, G-5, G-5A			[9.52]	[73.02]
LVR-3	500	1000	.375	2 7/8
			[9.52]	[73.02]
RS-2, RS-2C, CW-2, CW-2C,	450	1000	.375	27/8
G-5C, G-6, LVR-2			[9.52]	[73.02]
RS-5, RS-7, CW-5,	SIMI -	800	.375	2 7/8
CW-7, G-10, G-12			[9.52]	[73.02]
LVR-5	ida) (700	.375	2 7/8
			[9.52]	[73.02]
RS-10, CW-10, G-15,	NAME OF THE PARTY	600	.400	3 3/8
LVR-10, MF-1			[101.60]	[85.72]

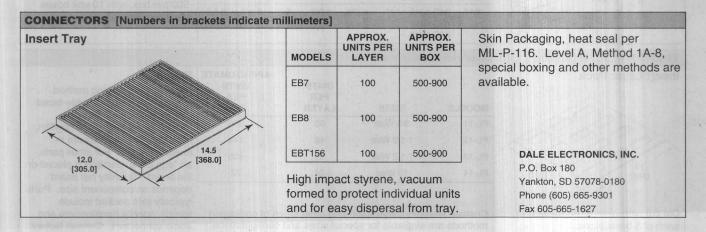
Note 2: Tape spacings standard options of 2 1/16" [52.39], 2 1/2" [63.50] available on request.

Note 3: Lead trimming 1/16" [1.59] from tape edge available on request as a standard option.

Note 4: CA-4000 and CA-5000 series resistors will be taped at .200 pitch, tape space will be dependent upon body length.

DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

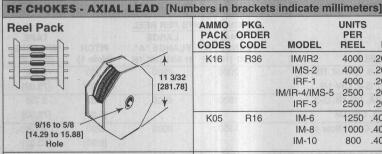
NTC THERMISTORS					
PACKAGING CODE	TYPE	DESCRIPTION	BALE ELECTRONICO INO		
P06	Bulk	Coated, leaded thermistors in a 4" x 6" antistatic plastic bag.	DALE ELECTRONICS, INC.		
P20	Bulk	Disc style thermistors in a 4" x 6" or 6.5" x 10" antistatic plastic bag.	P.O. Box 26728		
R58	Tape & Reel	Chip style thermistors in 8mm embossed plastic tape.	El Paso, TX 79926-6728		
R85	Tape & Reel	Chip style thermistors in 12mm embossed plastic tape.	Phone (915) 592-3253		
T06	Tray	Chip style thermistors in molded waffle style trays.	Fax 915-595-8199		



Packaging Methods





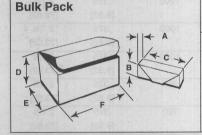


AMMO PACK CODES	PKG. ORDER CODE	MODEL	UNITS PER REEL	PITCH	TAPE SPACING
K16	R36	IM/IR2	4000	.200 [5.08]	2 1/16 [52.39]
		IMS-2	4000	.200 [5.08]	2 1/16 [52.39]
		IRF-1	4000	.200 [5.08]	2 1/16 [52.39]
		IM/IR-4/IMS-5	2500	.200 [5.08]	2 1/16 [52.39]
		IRF-3	2500	.200 [5.08]	2 1/16 [52.39]
K05	R16	IM-6	1250	.400 [10.16]	2 1/16 [52.39]
		IM-8	1000	.400 [10.16]	2 1/16 [52.39]
		IM-10	800	.400 [10.16]	2 1/16 [52.39]

Lead tape and reel packaging of axial lead components meets EIA RS 296 standard, including lead trimming.

Ammo Pack:

RF Chokes are lead taped the same as in reel pack, then placed in a continuous "S" pattern (without paper inner leaf) in an appropriate box.



PKG	a AS	UNIT BOX		INTERMEDIATE BOX			
ORDER	MODE	A	В	С	D	E	F
B08	IM/IR-2	1	1 3/8	3 5/8	3	3 3/4	5 3/8
	(200/Box)	[25.4]	[34.9]	[92.1]	[76.2]	[95.2]	[136.5]
	IM/IR-4	1 1/2	2	3 7/8	4 1/4	4	10 1/4
	(200/Box)	[38.1]	[50.8]	[98.4]	[106.4]	[101.6]	[198.4]
	IMS-5	2	2	3 7/8	4 1/4	4	10 1/4
	(200/Box)	[50.]	[50.8]	[98.4]	[108.0]	[101.6]	[260.4]
	IM-6	2 1/4	2 1/4	3 7/8	4 3/4	4	11 1/2
	(200/Box)	[57.2]	[57.2]	[98.4]	[120.7]	[101.6]	[292.1]

Axial units are uniformly packaged 200 per box, with 10 unit boxes per intermediate container.

70 per Box for IM-8, IM-9, IM-10.

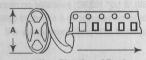
Note: ESD Packaging

also available.

SURFACE MOUNT INDUCTORS [Numbers in brackets indicate millimeters]

Carrier Dimensions

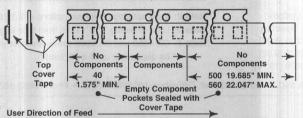
Tape and Reel Pack



User Direction of Feed

MODEL	PKG. ORDER CODE	REEL SIZE (Flange)	UNITS PER REEL
IMC-1812 ISC-1812	R13	"A" 13 [330.2]	2000
IMC-1812 ISC-1812	R73*	"A" 7 [177.8]	500
IMC-1210	R99	"A" 7 [177.8]	2000
* Additional	Charge	BROWN STREET	





P

MODEL	Р	Po	W
			.472 ± .012 [12.0 ± .300]
			.315 ± .012 [8.0 ± .300]

PKG **UNIT BOX INTERMEDIATE BOX** ORDER CODE MODELS B C E F B13 IMC-1812 1 3/8 3 5/8 3 3 3/4 5 3/8 ISC-1812 [25.4] [34.9] [92.1] [76.2] [95.2] [136.5] IMC-1210

Surface mount units are packaged 500 per box, with 10 unit boxes per intermediate container.

TRANSFORMERS [Numbers in brackets indicate millimeters]

Illseit Layer Fack
12 [305] 12 [305]

Insert I aver Pack

Die cut corrugated cardboard to fit each of 5 basic sizes.

MODELS	SIZES	UNITS PER LAYER	UNITS PER BOX	
PL-11	3/4 Watt	60	300	
PL-12	1 1/2 Watt	48	144	
PL-13	1 1/2 Watt	35	105	
PL-14	10 Watt	24	72	

Cushion wrapping, styrofoam and other types of packaging methods are available for special sizes and configurations.

Skin Pack

A versatile packaging method. Units are placed on double-faced corrugated board, then skin packed to the board with polyfilm. Most component types are in multiples of five. For small parts, an "egg crate" partition is placed on the board. Quantity per board depends on component size. Parts typically skin packed include toroids, special transformers and some connectors. Consult factory.